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Designing Forming Dies Along Natural Flow Lines

How Forming Dies for Drop-Hammers and Power Presses are Developed by the Sol-A-Die Process of the Solar Aircraft Co., San Diego, Calif., to Eliminate Thinning of Sheet-Metal Sections

By CHARLES O. HERB

ONE of the difficult problems confronting the fabricator of complex shapes from sheet metal is that of maintaining an even thickness of metal throughout all sections of the work. This is because, in forming deep complex shapes, it is almost impossible to avoid stretching and thinning in the direction of the drop-hammer blow or press action. Unbalanced tension causes stretching of the metal at points where the tension is greatest and consequent thinning of the metal cross-section at those points.

This thinning of metal is especially serious when it occurs in stainless-steel parts that are

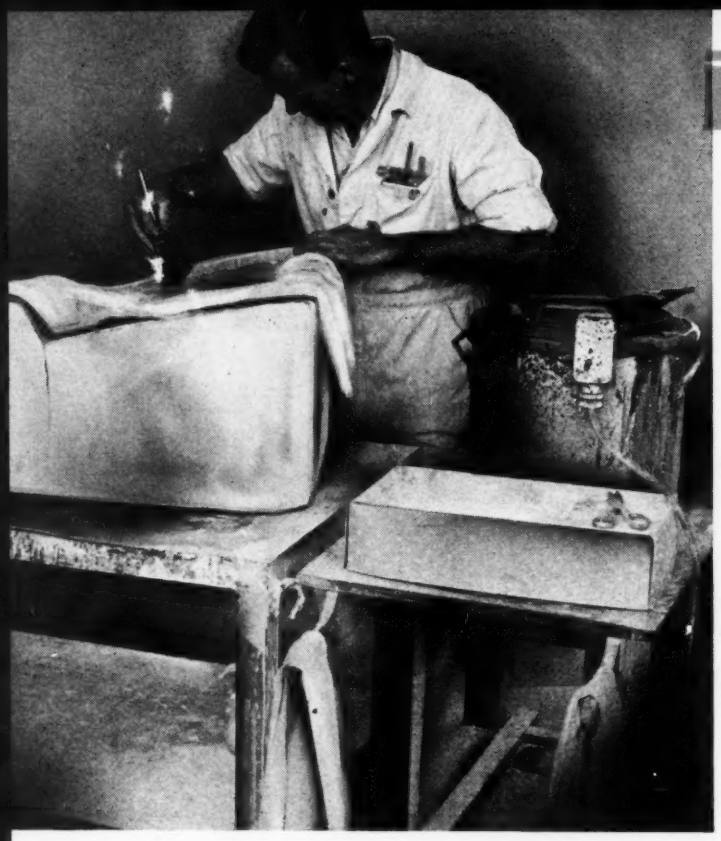
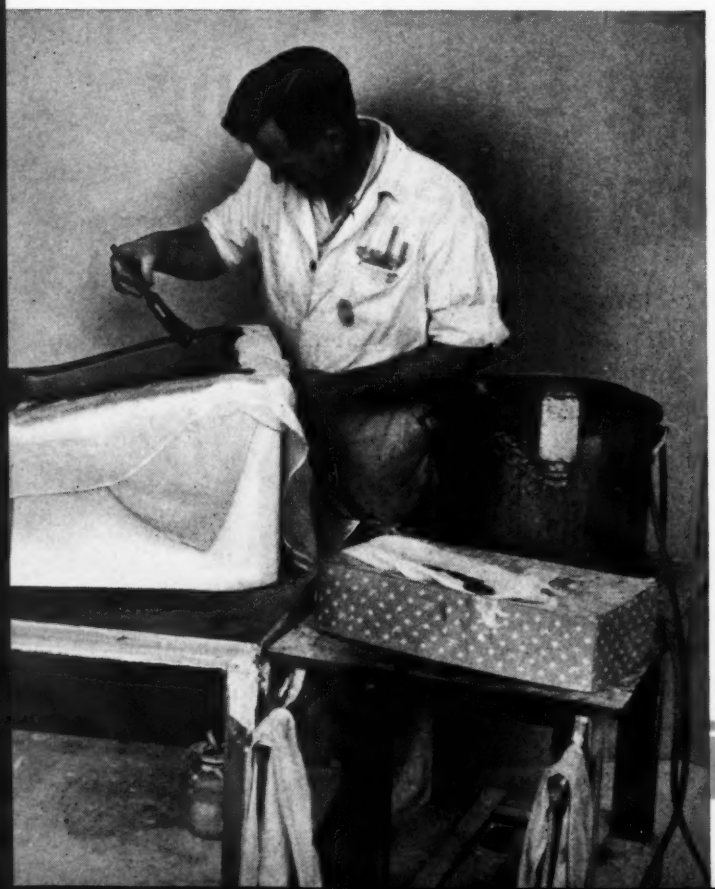


Fig. 1. Brushing First Sheet of Cheesecloth on Plaster-of-paris Pattern for a Final Die after the Pattern has been Coated with a Soapy Solution and a Thin Layer of Beeswax

Fig. 2. Applying Final Coat of Beeswax on Top of Several Laminations of Cheesecloth Used to Obtain a Flexible Work Pattern for Developing Preliminary Dies Required in Forming Metal Shapes



employed for airplane exhaust systems. The gases that pass through these systems are intensely hot, and when the metal is of varying thicknesses, it heats irregularly. Hot spots develop where the metal is thin, resulting in different coefficients of expansion, temperature stresses, and buckling. Erosion and corrosion progress at an accelerated pace on the hot spots as they become thinner and hotter. At the worst, fire may occur on an airplane because of premature failure of weak thin sections on the units that make up the engine exhaust systems.

The text-book rules of balanced design were practically useless in attempting to solve the thinning problems of the unusual shapes required in aircraft manifolds. Two men in the modeling department of the Solar Aircraft Co., San Diego, Calif. — Lewis E. Burger and Jennings B. Skinner—conceived the idea of developing forming dies on the basis of the natural flow lines of the parts to be manufactured instead of arbitrarily establishing the contours of the successive dies necessary for forming a given part.

This process of designing dies, which is known as "Sol-A-Die," is applicable whenever more than one die is required for forming a metal shape. It is especially useful in developing dies for shapes that must be formed to a considerable depth, and dies designed by this process will form such parts without greatly changing the size or shape of any portion of the metal being worked. Work-pieces can be formed in this way to sizes and angles that hitherto were believed to be impractical.

A Beeswax and Cheesecloth Pattern Similar in Contour to Required Work-Piece is Used

The Sol-A-Die process is based on the principle of first making a plaster-of-paris pattern of the final die required in the production of a metal shape and then working backward to develop the preceding dies necessary for forming the part. When the plaster-of-paris pattern for the final die has been completed from blueprints of the work, a pattern replica of the work-piece is built up in the die from laminations of cheesecloth and hot beeswax. This cheesecloth pattern is used in determining the shape of the preceding dies.

In making the cheesecloth pattern of the work,

a tincture of green soap is first painted on the working surfaces of the plaster-of-paris pattern, after which beeswax, heated to a liquid state, and sheets of cheesecloth are applied in successive layers until a pattern about 1/8 inch thick is obtained, this pattern, of course, having the same contours as the finished work will have. When the pattern cools, it stiffens, and can be readily removed from the plaster-of-paris pattern because of the soapy coating on the pattern.

The beeswax and cheesecloth pattern, although flexible, neither stretches nor shrinks, no matter how its contours may be altered. It can therefore be conveniently employed in producing plaster-of-paris patterns for the preliminary dies required in forming a part—that is, the first-, second-, and third-stage dies used before the final die.

In planning to produce the pattern for the next to last die of a series, the beeswax and cheesecloth pattern is heated over an electric heater until it becomes pliable. Then, the four sides of the pattern are unfolded outwardly until the pattern has been reduced in depth an amount that would be considered feasible for one press or drop-hammer operation on the metal to be formed by the final die. In this flattening of the beeswax and cheesecloth pattern, the contours follow the natural flow lines.

The beeswax and cheesecloth pattern is then used as a mold in pouring the plaster-of-paris pattern for the next to last die. The beeswax and cheesecloth pattern may be warmed again, opened out further in all directions, and used as a mold for the plaster-of-paris patterns for all of the earlier stages until one is reached that has such easy slopes that little deformation will take place in arriving at the full area of the first die of the series. During all of this time, the surface area of the pattern never

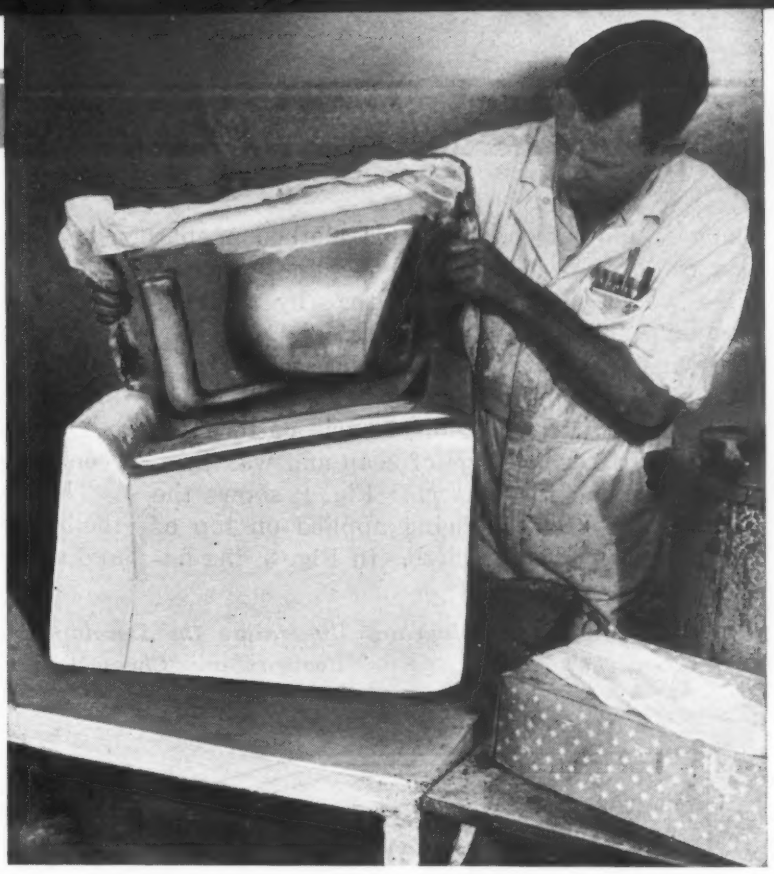


Fig. 3. Removing Beeswax and Cheesecloth Pattern from Plaster-of-paris Pattern of Final Die prior to Trimming Wax Pattern for Use in Developing Patterns for Preliminary Dies

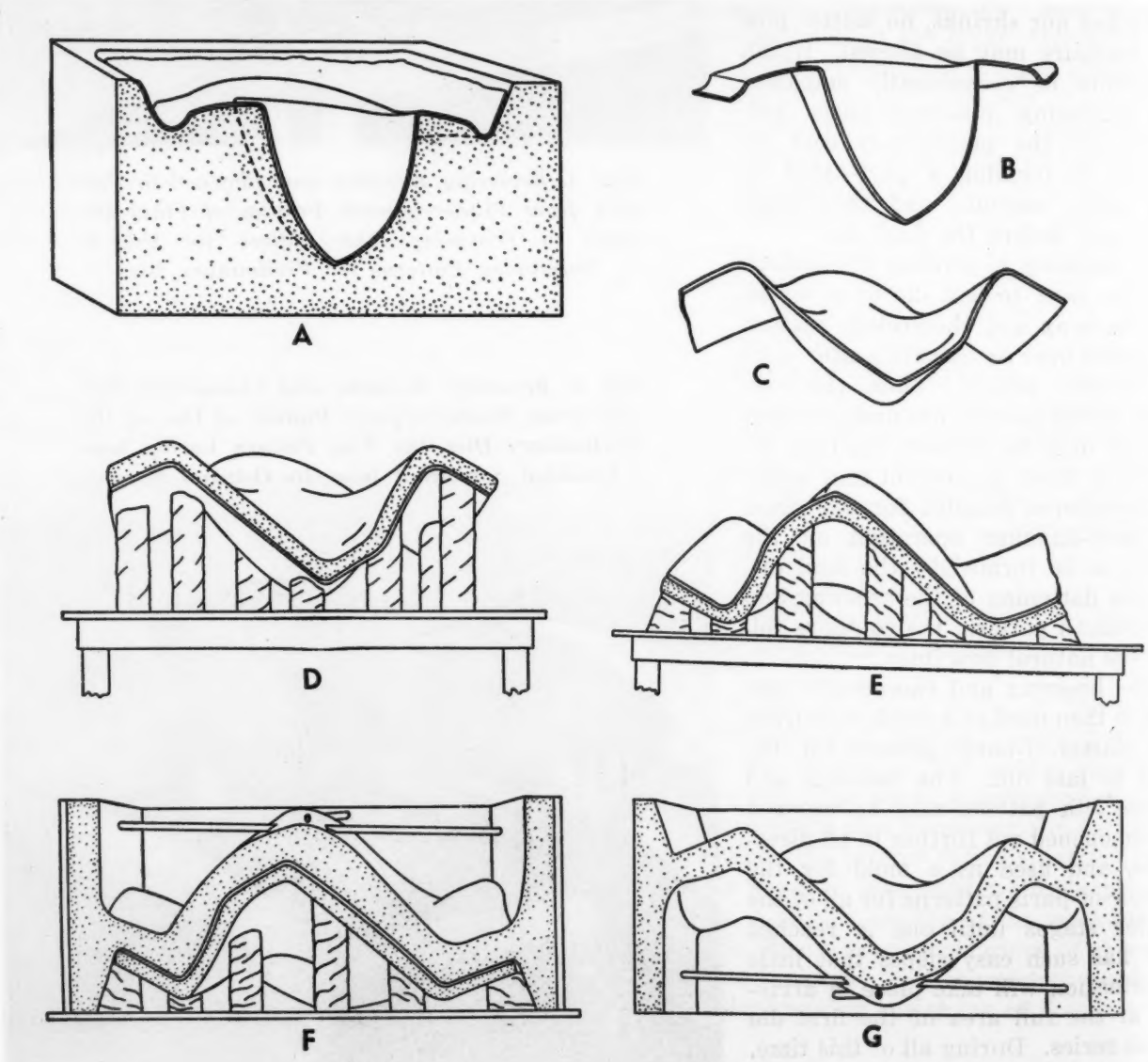
Fig. 4. Removing Beeswax and Cheesecloth Pattern from Plaster-of-paris Pattern of One of the Preliminary Dies, the Wax Pattern having been Unfolded Somewhat from Its Original Shape

changes—only its shape. This method enables dies to be developed along the lines that an artist would visualize rather than by the rule-of-thumb technique of engineers.

In Fig. 1, the first layer of cheesecloth for a work-piece is being brushed firmly on the working surfaces of the plaster-of-paris pattern for a final die, after coatings of soap and wax have been applied to the pattern. Fig. 2 shows the final coat of beeswax being applied on top of several layers of cheesecloth. In Fig. 3, the finished beeswax and cheesecloth pattern is being taken from the die pattern, while Fig. 4 shows the same beeswax and cheesecloth pattern being drawn out or unfolded for molding a plaster-of-paris pattern for one of the preliminary dies. As previously mentioned, this pattern will be drawn out or unfolded to a much greater extent than seen here.

The diagrammatic sketches in Fig. 5 show how the beeswax and cheesecloth pattern is produced and applied. At *A* is seen a plaster-of-paris pat-

Fig. 5. Diagrams Illustrating the Development and Application of the Beeswax and Cheesecloth Pattern



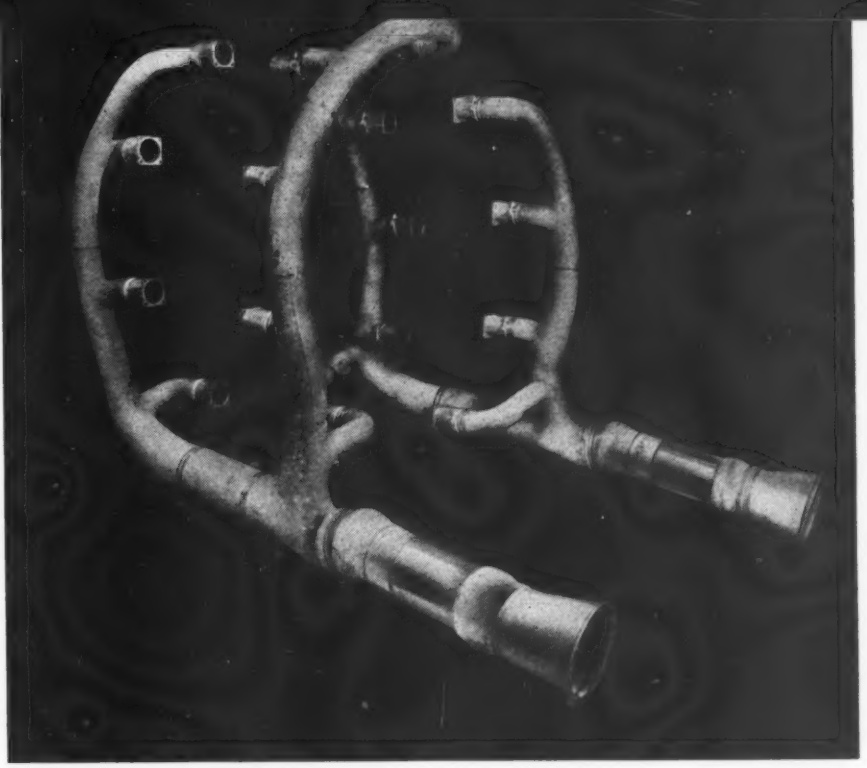
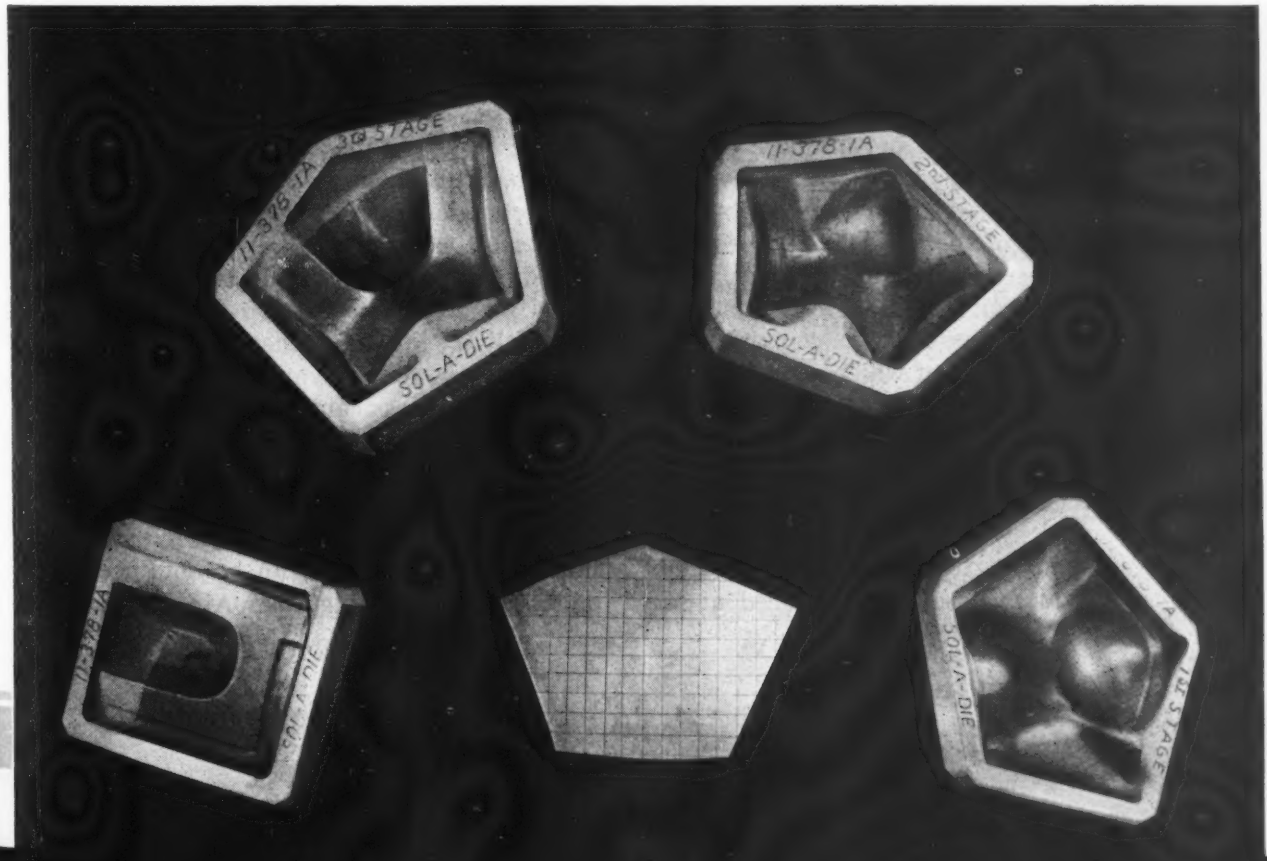


Fig. 6. (Right) Manifold for Engine of a Large Bombing Plane which Comprises Forty-four Stainless-steel Stampings Produced in Dies Designed by the Sol-A-Die Process

Fig. 7. (Below) Plaster-of-paris Patterns for the Four Dies Required in Producing the Part Seen in the Left-hand Pattern, from the Sheet-metal Blank Shown at the Bottom Center of the Illustration

tern for a die that is employed to produce a sheet-metal part of many contours. The "Sol-A-Wax" beeswax and cheesecloth pattern is seen in the die pattern. At *B* is shown an outline of the Sol-A-Wax pattern trimmed, ready for use in developing a plaster-of-paris pattern for a preceding die. The same beeswax and cheesecloth pattern unfolded for use in producing the plaster-of-paris die pattern is illustrated at *C*, while *D* shows the Sol-A-Wax pattern bolstered up in clay on a table, with a plaster-of-paris backing about 2 inches thick applied to it.

The backed-up pattern is placed on the table in an inverted position, as shown at *E*, and after being enclosed in vertical boards, plaster-of-paris is poured to obtain a pattern of the shape indicated at *F*. This plaster-of-paris pattern is illustrated at *G* after its removal from the Sol-A-Wax pattern. The plaster-of-paris patterns are used to form sand molds in which Kirksite or other suitable die material is cast for making the dies. Lead punches are later cast in the Kirksite dies or where a harder punch is desired, a pattern for it can be cast by using the die pat-



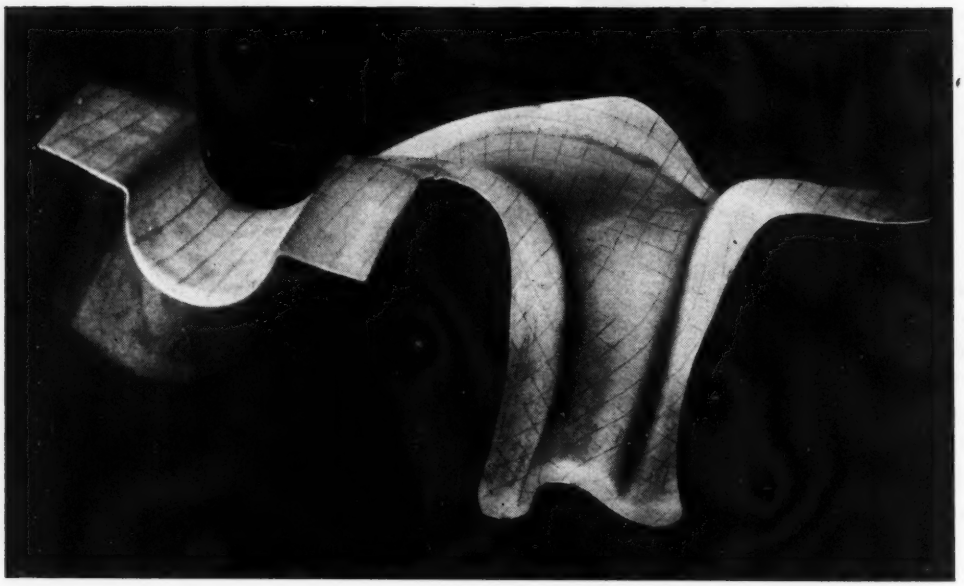


Fig. 8. Grid Lines Scribed on the Sheet-metal Blank prior to the First Operation Provide a Means of Visualizing any Stretching of the Metal that may Occur during Successive Forming Operations

tern, modified by laying a sheet of beeswax in it to represent metal thickness. In making steel dies for the quantity production of parts, the Sol-A-Die patterns may be employed in the sand for casting the dies and later on die-sinking machines for machining them to exact size.

As mentioned, the principal advantage of designing dies by the Sol-A-Die process is the prevention of stretch in forming operations and the resultant elimination of thin spots on work-pieces. Another important advantage, however, is the large time-saving effected in tool design. Actual records show a saving of from 30 to 40 per cent in designing time. Because dies are produced in accordance with the natural flow lines of the sheet metal being worked, more complicated work shapes can be produced than is usually possible, and this reduces the amount of welding required in the assembly of units.

The applicability of the Sol-A-Die process may be realized by reference to Fig. 6, which shows a stainless-steel manifold assembly for a large bombing plane. This assembly is constructed of forty-four stampings, all of which were produced in dies designed by this method. It is important to note that the assembly is 300 pounds lighter than a similar manifold produced from dies designed in the conventional manner.

Dies developed by the process here described have been used successfully on sheets from 0.009 to 0.098 inch thick. The dies produced at the Solar Aircraft Co. have been employed mostly on 18-8 stainless steel, but dies made by this process have also been applied successfully on aluminum and Alclad sheets.

To check the stretching or other deformation of metal on parts made by these dies, grid lines are customarily scribed on a work blank to form squares, as seen on the blank in the center of the bottom row in Fig. 7. Any appreciable change of area in one of these blanks during the forming of the work-piece can be readily observed. This illustration also shows the plaster-of-paris patterns of the four dies used in forming the blank into the shape seen in the fourth-stage die pattern at the left. The grid lines on the more complicated stamping in Fig. 8 indicate clearly how the areas confined by the grid lines remain uniform, even though the squares may change into rectangles or other geometric figures.

The more complicated the metal shapes to be formed, the more applicable the Sol-A-Die process is for designing the dies and the more economical it is to employ the process. It is especially suitable for unsymmetrical work shapes. In fact, the process cannot be applied with much success on such parts as cylindrical cups because the beeswax and cheesecloth work patterns cannot be satisfactorily unfolded.

The Sol-A-Die process has been patented by the inventors. Licenses can be obtained for its application through the Solar Aircraft Co.

Need for Realistic Depreciation of Machine Tools

Abstract of a Paper Presented at the Annual Meeting of the Machinery and Allied Products Institute by Herbert H. Pease, President of New Britain Machine Co., and President of National Machine Tool Builders' Association

THE prevailing practices of many companies in setting up depreciation reserves on fixed assets are not realistic, for a great many reasons, and the replacement reserves set up are not sufficient to provide replacement. It is not necessary to argue this point. Everyone knows that a machine tool which cost $5000 sixteen years ago cannot be replaced for $5000 today, and yet the Treasury Department only allows concerns to depreciate a machine at the rate of 6 per cent annually, which necessitates about sixteen years for complete depreciation. Such a formula results in the erosion of capital, the underestimating of costs, and probably the underpricing of products.

Another and far more important result is the fact that industry generally is discouraged from purchasing modern cost-reducing machinery because concerns know that they cannot get back the cost of replacement in dollars of the same purchasing power under this formula or get the tax deduction they are entitled to. Some companies keep two sets of books and try to take a realistic write-off each year, whether or not it is subject to tax deduction, and also try to be realistic as to costs and prices. Others try to make machine tools pay for themselves over a short period of years out of savings or additional profits, and set up extra reserves for replacement out of these taxable profits. This is not fair to the company, however, and does not balance out until the machines are disposed of or scrapped.

By and large, however, these methods are not followed by the great majority of manufacturers—for good reasons, perhaps. Most manufacturers look at Government regulations and keep their books on that basis, realizing that they are not building adequate depreciation reserves, but hoping to make additional profits to compensate and to be able to meet the issue of replacement costs when the time comes. In any case, the depreciation permitted by the Government is a deterrent to the buying of machines, and cost-reducing machinery is not bought as freely as it would be if we had an understanding, realistic treatment of this matter in Washington.

A change is needed in the conception of depreciation as based on the number of years that a machine will last physically. From the standpoint of the national good, it is a small matter how much might be lost in taxes by changing this conception. As a matter of fact, nothing would be lost eventually if a 100 per cent write-off were allowed every year, except the interest on the first year of about 38 per cent on, say, $250,000,000, or $95,000,000. With interest at 1 per cent, the Government would lose only $950,000. The increased profits made by the users of this new equipment would probably more than balance this out.

From the standpoint of the national good, it is an important matter to keep our national income at its present high level, or increase it if possible. By encouraging the use of cost-reducing machinery, the Government could go a long way in attaining these objectives. Users of machinery must be protected so that their capital is not dissipated by erosion. To have the confidence to buy machine tools, they must be allowed to set aside promptly replacement reserves in dollars of the same purchasing power. The policy of depreciation allowance by the Government should be based on this conception.

There are many approaches to a realistic depreciation program; however, too many of these are involved and require complicated accounting. In my opinion, the approach should be simple and obtain prompt results. From the standpoint of the national interest it would be advantageous for all industries to be in a position

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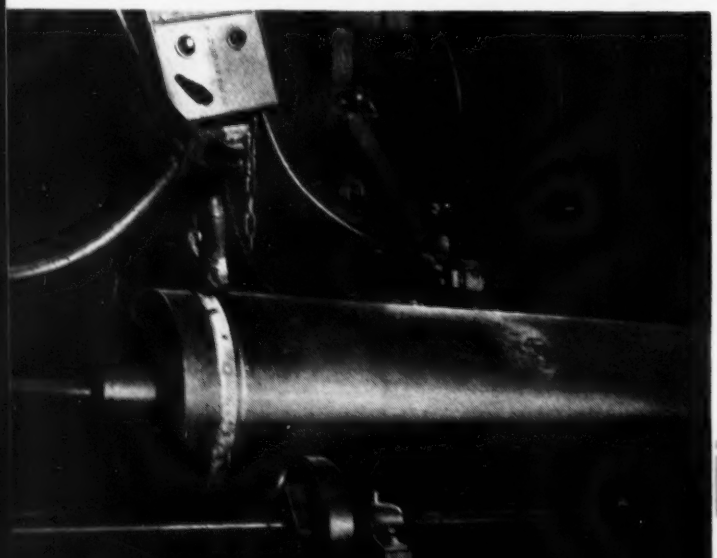
Fabrication and Welding of



THE minimum requirement for water-heater tanks is that they function unfailingly under the most severe pressures. All design and construction must be based on that requirement, and any change in the manufacturing process must pass the strictest kind of testing before it can be accepted.

The Hoosier Industries, Inc., of La Porte, Ind., have reported notable success in applying the automatic metallic-arc welding process in the construction of their oil-fired water heaters. Production time and costs have been cut and the heaters meet all performance requirements.

The important steps in the manufacturing process are, briefly, as follows: Hot-rolled steel of 12-gage thickness is squared and sheared to 47 by 44 inches, as illustrated in Fig. 1. Using only one punch press, nine openings, including the rectangular burner door opening at the bottom of the tank, the hole for water-pipe connections, and the screw-holes for attachments, are stamped out and pierced.

One edge of the sheet is then rolled in a preliminary operation so that a uniform curvature is obtained in the final rolling operation, after which the longitudinal joint is butt-welded. This weld, 47 inches long, is made with the automatic metallic-arc equipment shown in Fig. 2. Complete penetration is obtained, and the joint is made in approximately twenty-seven seconds.

After several hand-welding operations on brackets, etc., with a 1/8-inch diameter electrode that conforms to American Welding Society Specification E 6010, the top and bottom heads are pressed into the tank by a hydraulic press. Another automatic machine welds the top head tc the shell in one pass, requiring twenty-two seconds. The tank rests on rollers, and is turned by a ring which presses against the head of the

Fig. 1. (Top) First Operations on the Oil-fired Water-heater Tank Include Shearing the Sheet to Size and Punching Nine Holes

Fig. 2. (Center) After Rolling the Sheet, an Automatic Metallic-arc Machine is Used to Butt-weld the 47-inch Joint

Fig. 3. (Bottom) The Head, or Top, of the Tank is Welded to the Body on a "Lincolnweld" Automatic Machine in Twenty-two Seconds

Oil-Fired Water Heaters

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tank under pneumatic pressure, as shown in Fig. 3.

The bottom is then welded to the tank by automatic metallic-arc equipment that creates a weld which penetrates through the tank wall into the flange of the pressed-in bottom. The tank is turned by the rollers on which it rests, and is held down by the pneumatically actuated arm seen in Fig. 4. It is located lengthwise by other rollers, also pneumatically actuated. This weld is made in about twenty-two seconds.

At this point a 6-inch diameter seamless steel tube is inserted through the necked openings in the top and bottom stampings. This tube, which is the flue for the oil burner, is located and arc-welded to both the top and bottom heads by the machine shown in Fig. 5. The machine locates the component parts pneumatically.

The tank is now ready for testing to determine structural weaknesses or leaks; this is accomplished by subjecting it to a hydrostatic pressure of 300 pounds per square inch.

Foreign matter, such as scale, rust, or grease, detrimental to standard galvanizing procedure is removed by a hot bath (160 degrees F.) in sulphuric acid. This bath is followed by a rinse in cold muriatic acid. After being dried, the tanks enter the galvanizing pot, passing first through the flux chamber and then into the molten zinc bath, as shown in Fig. 6.

Finally, the openings are tapped on a specially designed machine; nipples are inserted; and the tank, under 35 pounds per square inch air pressure, is submerged in water to check for leaks. The tank is kept under this air pressure during installation of the oil burner and assembly of the outer jacket. The pressure is tested before being released at the end of the assembly operations, any drop indicating a leak in the tank.

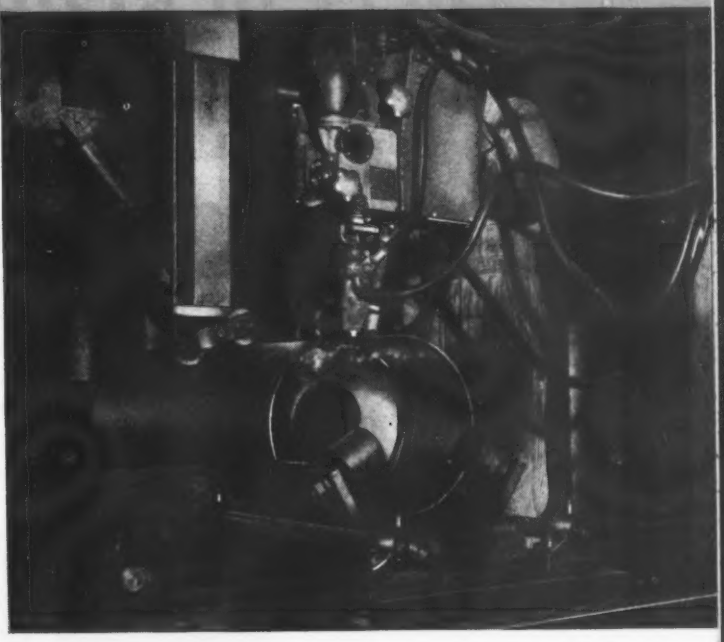

Fig. 4. (Top) Another Metallic-arc Welder is Used to Join Bottom to Tank. Complete Penetration is Obtained with This Equipment

Fig. 5. (Center) The Flue, a Piece of 6-inch Seamless Steel Tubing, is Located and Welded by Machine at Both the Top and Bottom

Fig. 6. (Bottom) Finally, the Tanks are Galvanized, Tapped, and Tested. Eight and One-half Pounds of Zinc are Required per Tank

Obsolete Machines Are Useless

LET us not, as a nation, make the same mistakes a third time! Our experiences in two wars within a single lifetime should have taught us the importance of being prepared for effective action through recognition of the vital part that machine tools must play as the first line of defense. Everything else in the great war machine has to wait until the machine tools, basic to all metal-working, are ready in numbers sufficient to produce enough to arm the nation.

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We could have learned that in World War I. We should have learned that in World War II, when we repeated so many of the same mistakes. The burden of arming the Allies fell, in great measure, upon the metal-working industry of the United States. If there is a third World War—and if it lasts longer than thirty minutes—the same burden of providing the vastly more complex weapons of the newest war will fall, in the first instance, upon machine tools, and their availability in numbers sufficient to start production at once will be vital to the nation's defense.

Let us all hope and pray that we will have permanent peace upon this earth. Let us all remember that the nation which loves peace must be the nation that is strong enough to enforce the peace. Obsolete machines cannot win a war. Neither can they win in peacetime. It is hoped that another national emergency will find our industry so well prepared in time of peace that it will be ready in case of war. Let us be so well organized that we can produce, without delay, the enormous number of machines required, and this without the fumbling which we went through in the early years of the last war.

There have been suggestions that a Civilian Production Institute be organized which will coordinate the information gained at such tremendous cost during the past war; which will bring together the production data of the Army, Navy, Air Corps, Coast Guard, and the like and prepare a perfected organization plan that could be carried through in the case of another emergency. Let us not waste this vast fund of information which we have gained. Let us also, as individual manufacturers, keep our own plants up to date, ruthlessly scrapping obsolete machinery for our own best interests in time of peace as well as of war.

The retention of substantial reserves of idle machine tools by the armed services, so that we will not be caught again as we were in 1941 should an emergency come upon us, is a step in the right direction. The placing of surplus machine tools in the trade schools of the nation is another fine activity—one, I am sorry to say, that has not reached any great proportions. In spite of efforts of the industry, very few machines have gone to schools. The schools that need the machines could not afford the prices quoted to them until recently by the War Assets Administration. It is to be hoped that the recent regulation permitting transfer of machines to educational institutions without charge will change this situation materially.

The entire reserve of all the armed services, not including machines installed in arsenals and yards, is probably less than one month's output of the industry at wartime peak. In the face of a decidedly uncertain international situation, we are destroying part of our war potential that

in War—Profit-Eaters in Peace

By JAMES Y. SCOTT
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just does not exist in our shops in times of peace —that cannot hastily be improvised or commandeered. We have learned in two wars that it is hard to get machines fast enough in time of war. They must be reserved and ready in time of peace. And since the art of war is shifting and fundamental changes may be expected in the types of weapons and ammunitions required in the case of another emergency, it seems obvious that only the latest and best machines will be of any value in that emergency.

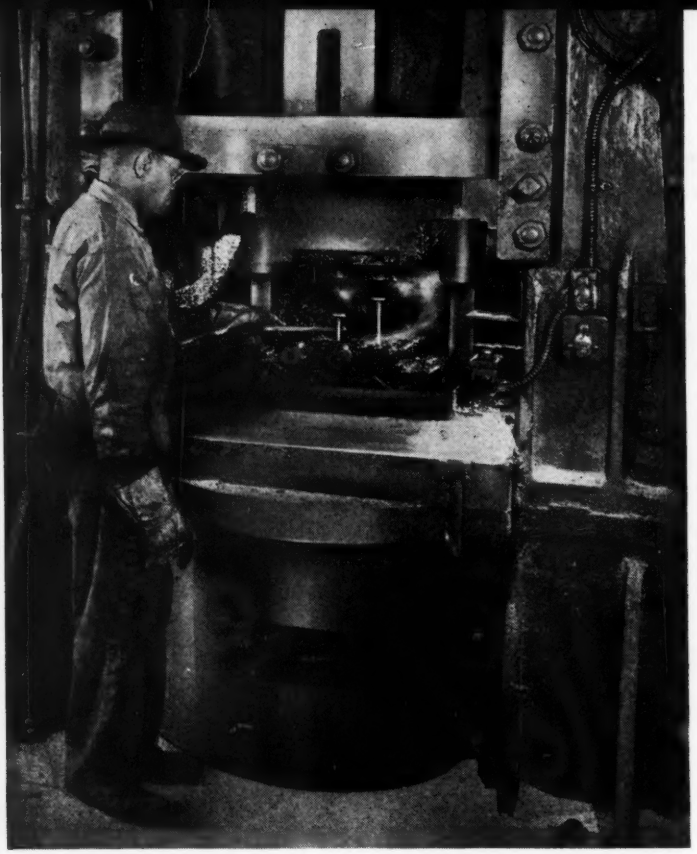
In modern history there has probably been no better time for the nation to take cognizance of the rapid developments in machine tool design and operation than today. The world is waiting to get started again. In peacetime operation, costs are becoming of increasing importance. So the Machine Tool Show in Chicago, at the huge Dodge-Chicago plant of the Tucker Corporation, from September 17 through 26, is most timely. For the first time since 1935, all the products of the industry, totaling more than 1000 operating machines of 220 types, will be on display at one place, in the world's greatest machine shop.

The solution to wartime needs is the solution of peacetime production — more efficient machines that will produce more. Greater production per man means lower costs in peacetime; lower costs mean more goods for more people. Obsolete machines are useless in war—profit-eaters in peace. Greater production per man can be secured by improved machine tools, improved cutting tools, improved methods of handling products, improved product engineering, and improved man-hour efficiency. All of these can combine to bring about a higher rate of productivity and a consequent raising of the standard of living for the nation, despite increased material and wage costs.

It is becoming apparent, as the weeks go by, that the installation of modern machine tools offers to American industry that most desired result of "more goods for more people at lower cost." Government surplus has enabled many factories to bring their physical plants up to at least the standard of the second World War. This has not been costly for these manufacturers, but too many of the smaller plants are still far out of date in their equipment. Even the very best of the aircraft manufacturing plants admit that half of their equipment has become obsolete since the war ended.

The management of our manufacturing plants has the responsibility to see that everything possible is done to make capital investments pay out promptly by reduction of costs and increased productivity. All machinery manufacturers will recall that sixty months' amortization was the rule for the war needs and was permitted by the United States Government. Some of our most modern factories are the result of far-seeing policies of those organizations that took advantage of that plan. But today, much of this equipment may be obsolete.

Now is the time for American industry to see what has been going on in the machine tool industry during the war years. Today's machine tools have taken a big step forward in productivity and in design. They are well worth seeing. There is only one solution to our present high labor costs; that is greater production per man. The modern machine tool is designed to raise this productivity and thereby lower costs and increase business. Machine tool builders have brought their wartime experience to the drafting board and now to the production line. New developments and new techniques have brought new performance. And that is what you will see in Chicago in September.



Producing

AN unusual method of producing automotive valves is employed at the Chevrolet-Flint Manufacturing Division of the General Motors Corporation. Here both the inlet and exhaust valves are extruded from hot steel slugs on power presses. The millions of valves in operation in Chevrolet automobile and truck engines attest the efficiency of this process. The details of this application of the extrusion process are described in the following.

Hot-rolled steel bar stock with sheared ends, in lengths of from 5 to 7 feet, is used to produce the slugs. Inlet valve slugs are made from 1 1/4-inch diameter steel bars containing 0.40 per cent carbon, 0.35 per cent manganese, 3.90 per cent silicon, 2.20 per cent chromium, a maximum of 0.03 per cent phosphorus, a maximum of 0.04 per cent sulphur, and the balance iron. Exhaust valves are made from 1 1/8-inch diameter steel bars having a special composition that contains a high percentage of nickel, and are capable of being air-hardened to a minimum hardness of 42 Rockwell C.

The bars are heated, in preparation for shearing into slugs, in a gas-fired furnace, which is maintained at a temperature of 1250 degrees F. When sufficiently hot, the bars are pulled from the furnace by means of tongs and laid four abreast on the feed rollers of a Buffalo billet shear, as shown in Fig. 1. The rollers, which are driven directly from the intermediate shaft of the shear, automatically feed the stock forward the required amount at the completion of each shearing operation.

Inlet valve slugs are cut approximately 0.822 inch long and exhaust valve slugs 0.842 inch long, resulting in about eighty-six slugs per 6-foot long bar. The bars have cooled to from 1050 to 1125 degrees F. by the time they are sheared, and this temperature range has been found to give the longest shear blade life.

The slugs are tumbled in steel shot to remove scale from their surfaces, and are placed in small gas-fired furnaces for heating to the extruding temperature. The furnaces, which hold from fifty-five to seventy slugs, are maintained at a

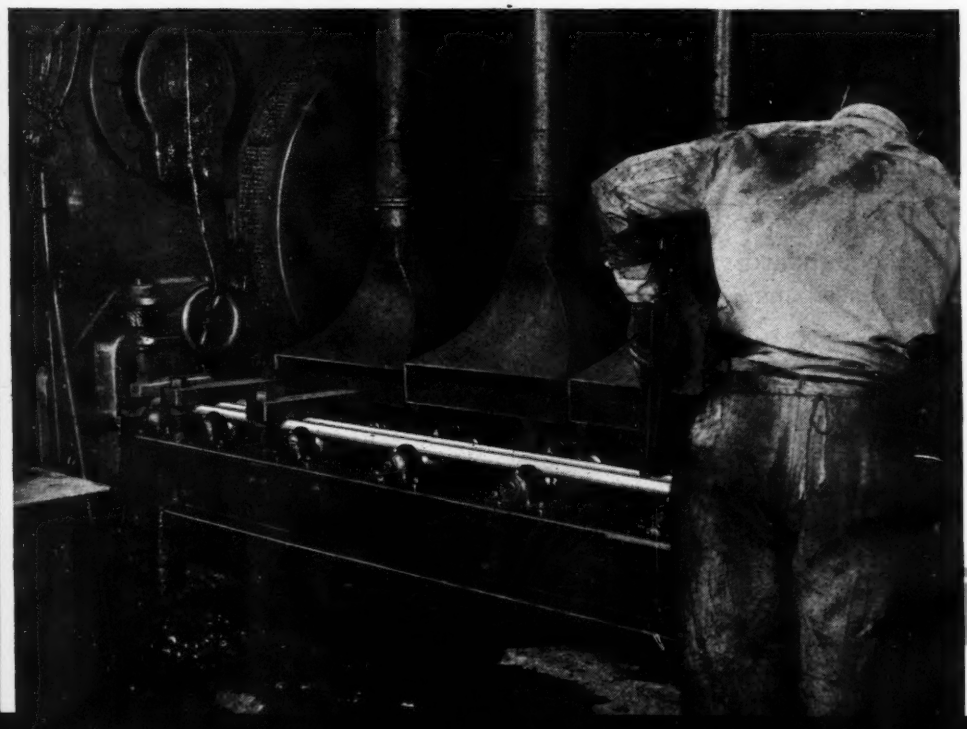


Fig. 1. Heated Bars are Placed Four Abreast on the Feed Rollers of a Shear and are Automatically Cut into Slugs About 0.822 Inch Long

Automotive Valves by Extrusion

Both Inlet and Exhaust Valves for Automobile and Truck Engines are Extruded from Hot Slugs of Steel at the Chevrolet-Flint Manufacturing Division of the General Motors Corporation, Flint, Mich.

By CHARLES H. WICK

temperature of 1875 degrees F. The slugs remain in the furnace from seven to ten minutes. As the operator removes a hot slug with tongs, he replaces it with a cold part. It is contemplated to use induction heating for this operation in order to increase production and insure more uniform heating of the slugs.

The heated slugs are extruded and coined into the desired shape on ten Cleveland 400-ton presses, such as the one shown in the heading illustration. A two-position die and two-stroke cycle is being employed at the present time. Special hot-forging grease is applied to the die by means of a hand brush. Experiments are now being conducted with automatic die lubrication. The first operation consists of placing the hot slug in the right-hand die, as shown in Fig. 2. The construction of this two-stage die is shown in the partial cross-sectional view, Fig. 3.

As the ram of the press descends, extruding punch *P*, which is mounted in holder *H*, forces the metal through die *R*, insert *E*, back-up block *F*, and bushing *G* at the rate of approximately 43 feet per minute. On the up stroke of the ram, a spring-actuated knock-out pin connected to the ram enters bushing *G* and ejects the extruded valve from the die, as shown in the heading illustration. After some time, the lower face of hardened and ground punch *P* becomes scored from its repeated impact with hot slugs. When this occurs, approximately 0.005 inch is ground from the face, and compensation is made in the die by using repair blocks *F*, which are made in fifteen sizes varying in height by increments of 0.005 inch.

Upon the completion of the extrusion, the operator transfers the valve to the coining die at the left, and a second operator places another slug in the extruding die. When the ram again descends, coining punch *B* presses the valve into the shape formed by the inside diameters of die *C*, insert *D*, and anvil *A*. Stamp *S*, which is mounted inside the coining punch, forms a dip in the valve dome and impresses the trademark and size in this surface.

Die rings *O*, in which the extruding and coining dies are pressed, are the same size. Coining die *C* is the same size as extruding die *R* except for the inside diameter, which is 0.008 inch larger. Inserts *D* and *E* are of identical size, except that the coining insert *D* has a 0.006 inch larger bore, or stem hole, and its radii blend

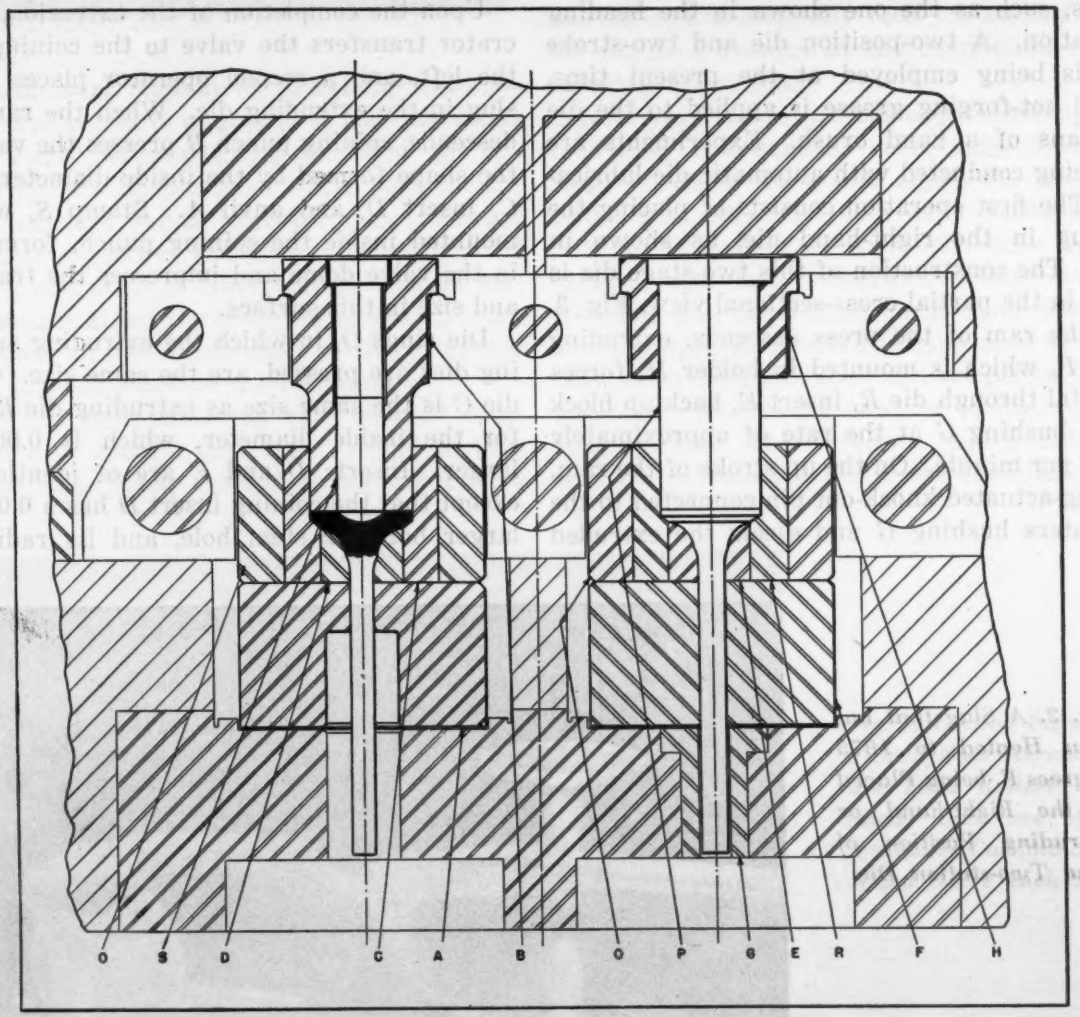
Fig. 2. A Slug that has been Heated to 1875 Degrees F. being Placed in the Right-hand or Extruding Position of the Two-station Die

with the stem hole at a line 0.023 inch farther from the top face of the insert.

At the end of the extruding and coining operation, the valves are placed in a chute at the rear of the press, from which they fall on an underground belt conveyor that carries them to the stem straightening machines. These machines are modified Waterbury-Farrel thread-rolling machines, equipped with two parallel, hardened-steel blocks. The valve, which is still hot from the extruding operation, is placed between the two blocks of the rolling machine, as shown in Fig. 4. The straightening block, mounted on the right-hand side of the machine, is stationary, and is provided with a guide that aligns the valve head with its stem. The reciprocating block, mounted on the left-hand side of the machine, straightens the stem as it rolls the valve along the stationary block. The valve falls from the end of the blocks into the chute seen in the foreground, down which it rolls into a container located under an exhaust hood that speeds the cooling of the valves to room temperature.

The head of the valve is now snag ground on Gardner two-wheel disk grinding machines to remove any burrs or flash left from the extruding operation. Medium-grain, aluminum-oxide abrasive disks, 18 inches in diameter, are used.

Fig. 3. Partial Cross-section of the Two-station Die, Showing the Coining Position at the Left and the Extruding Position at the Right



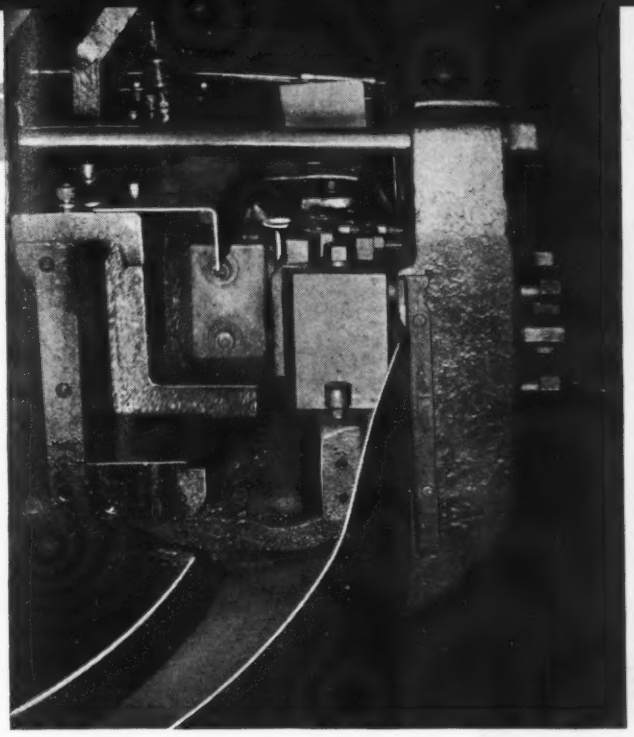


Fig. 4. Modified Thread-rolling Machine in which the Stem of the Hot Extruded and Coined Valve is Straightened

Fig. 5. Special Machine in which Valve Stems are Automatically Cut to Required Length by an Abrasive Cut-off Wheel

Next, the valve stems are cut off to the required length on a special machine built by Chevrolet, as shown in Fig. 5. The operator places the valves in an inclined tray down which they roll into slots on a rotating drum. The valves are confined in these slots during their single revolution on the drum by a shoe that closely conforms with the periphery of the drum. A hard, medium-grain, aluminum-oxide abrasive cut-off wheel, 12 inches in diameter by 3/32 inch thick, mounted in the base of the machine, is used to cut the valve stems to the required length. As the cut valves reach the front of the machine, they fall into the chute shown in the foreground.

As the exhaust valves are made from an air-hardening steel, they attain a hardness of approximately 50 Rockwell C due to the temperature to which they are heated preparatory to extrusion, and therefore require an annealing operation. This is not necessary in the case of the inlet valves which, as mentioned, are made from a different steel. The annealing of the exhaust valves is done in a conveyor type gas-fired furnace which is maintained at a temperature of 1230 to 1380 degrees F. The valves are subjected to this temperature for one hour and forty minutes, resulting in a hardness of approximately 30 Rockwell C.

The run-out of all valve stems is then checked by means of indicators while the valves are rotated on bench fixtures. Any straightening required is accomplished with a hammer and bench block.

The next step in the production of the valves consists of removing approximately 0.010 inch of stock from the valve stem diameter by rough-grinding on Cincinnati No. 2 centerless grinding machines. A 20-inch diameter by 5 1/2-inch wide vitrified-bond grinding wheel, and a 12-inch diameter by 5 1/2-inch wide rubber-bond regulating wheel are used in this operation.

The valve stems are semi-finish ground by removing approximately 0.006 inch from their diameters on similar machines equipped with the same kind of wheels. The valve seats are then finish-ground to a smooth surface, free from chatter marks, concentric with the valve stem, and conical within 0.003 inch indicator reading. This operation is performed on conventional Cincinnati and Fitchburg valve-seat grinders employing 20-inch diameter by 7/8-inch wide grinding wheels which are dressed to a 60-degree included angle, as shown in Fig. 6.

Grinding to length of the valve stems is accomplished on Gardner disk grinders equipped with a slow-speed drive attachment for the wheel dresser. Disk type grinding wheels 30 inches in diameter by 1 inch wide, are used in this operation. These sixteen-station, special

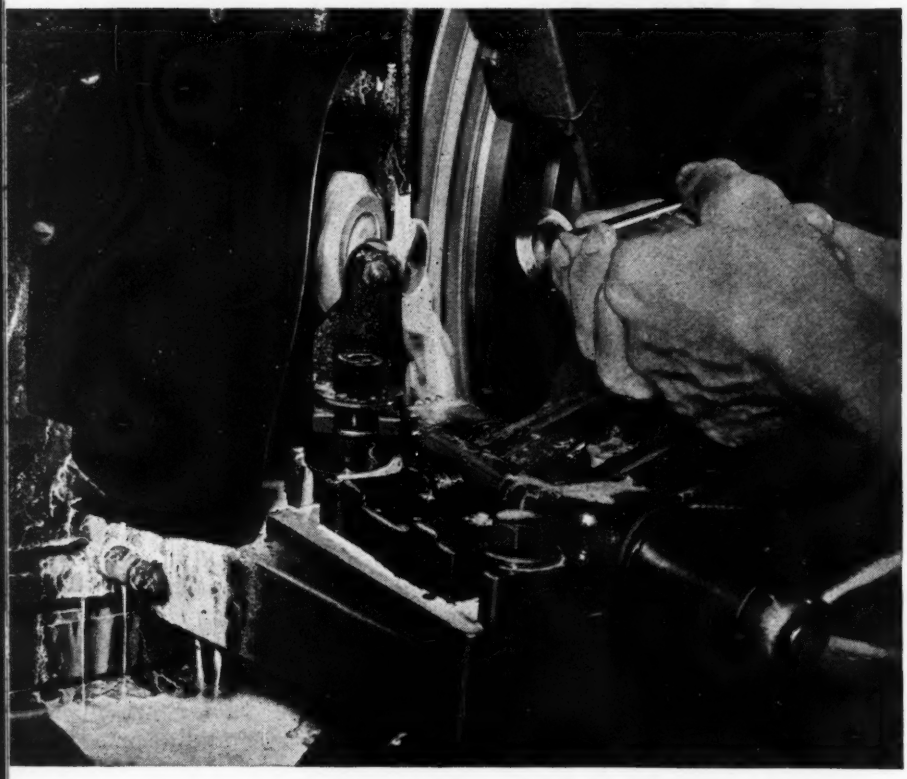


Fig. 6. A Conical, Smooth Valve Seat, Concentric with the Valve Stem, is Ground in This Operation, Using a Grinding Wheel that is Dressed to a 60-degree Angle

machines are provided with three-piece double-end collet chucks that hold the valve stems rigidly so that their ends can be ground square with the stem within 0.0006 inch. The sixteen-station table is rotated at two revolutions per minute.

The single groove in the valve stem and the chamfer on its end are now turned on special Ex-Cell-O eight-spindle, rotating lathes. A single form tool is used to cut both groove and chamfer on the valve in each spindle while the valve is rotated at 250 R.P.M. and the table revolved at 3 R.P.M.

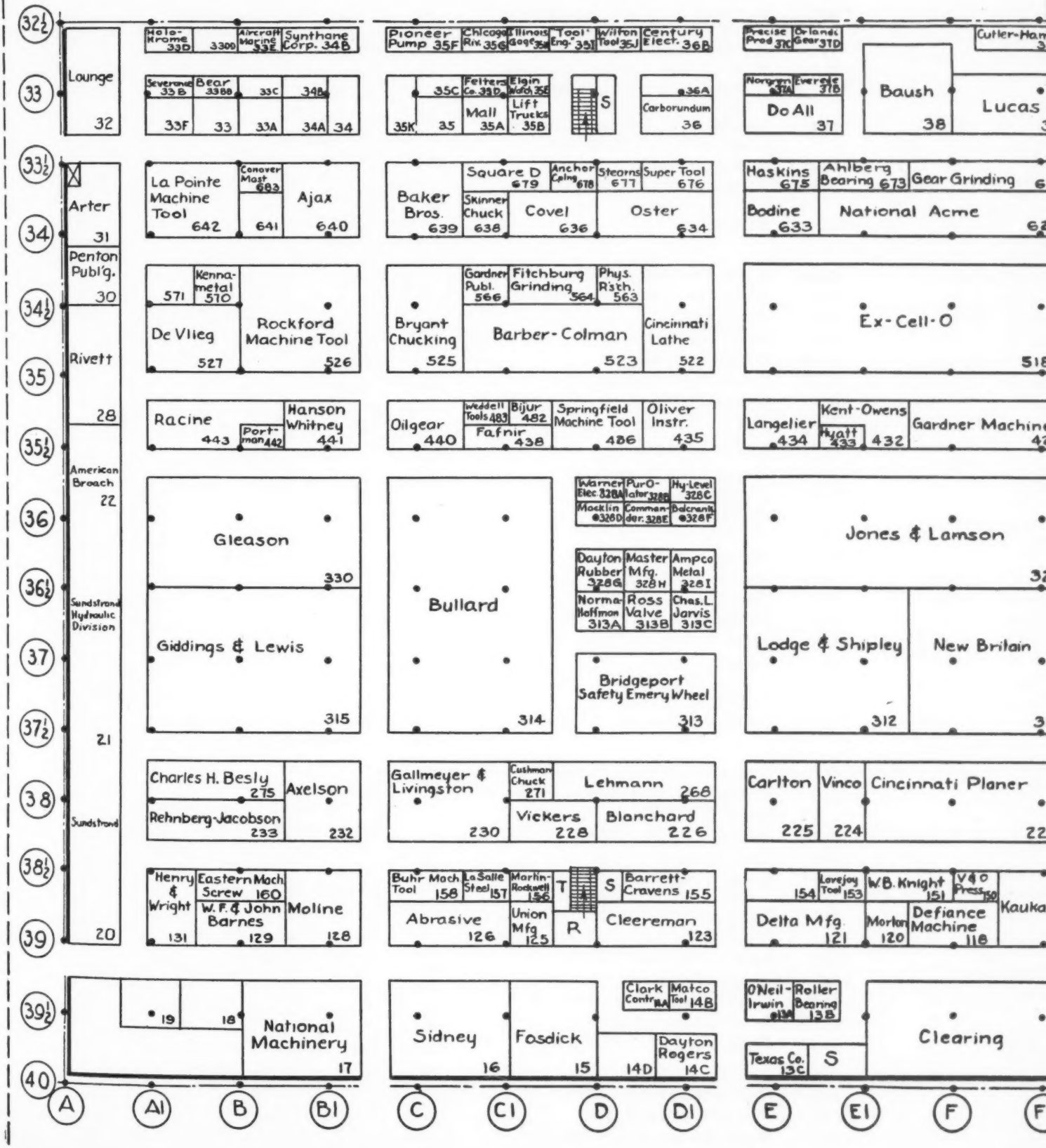
Finally, the valve-stem diameter is finish-ground on Cincinnati centerless grinders. In this operation, approximately 0.0025 inch of stock is removed from the diameter. After being washed, the finished valves are inspected both for size and finish.

New Industrial Uses for Zirconium

ZIRCONIUM and zirconium compounds are finding wider and more important uses in industry. According to the Rohm and Haas Co., zirconium alloys are being employed to eliminate impurities in molten steel, to make special copper alloys, and to impart the proper characteristics to the spinarets used in forming rayon fibers in rayon mills, and in other applications. Oxide of zirconium is used in molds for precision casting and in laboratory refractory ware. This type of refractory ware has been reported gas tight at 1000 degrees C. It is inert to almost every reagent, will not become fluid below 2600 degrees C., and has a very low coefficient of expansion.

Many of the compounds of zirconium have only recently become available and are still largely undeveloped industrially, but others, like zirconium stearate, which is an organic soap with possibilities as a lubricant, an additive for greases and oils, and a flatting and anti-sag agent for paint, show great promise. Other compounds have been suggested for use in flux coatings on welding rods.

Machine Tool Show, Doc



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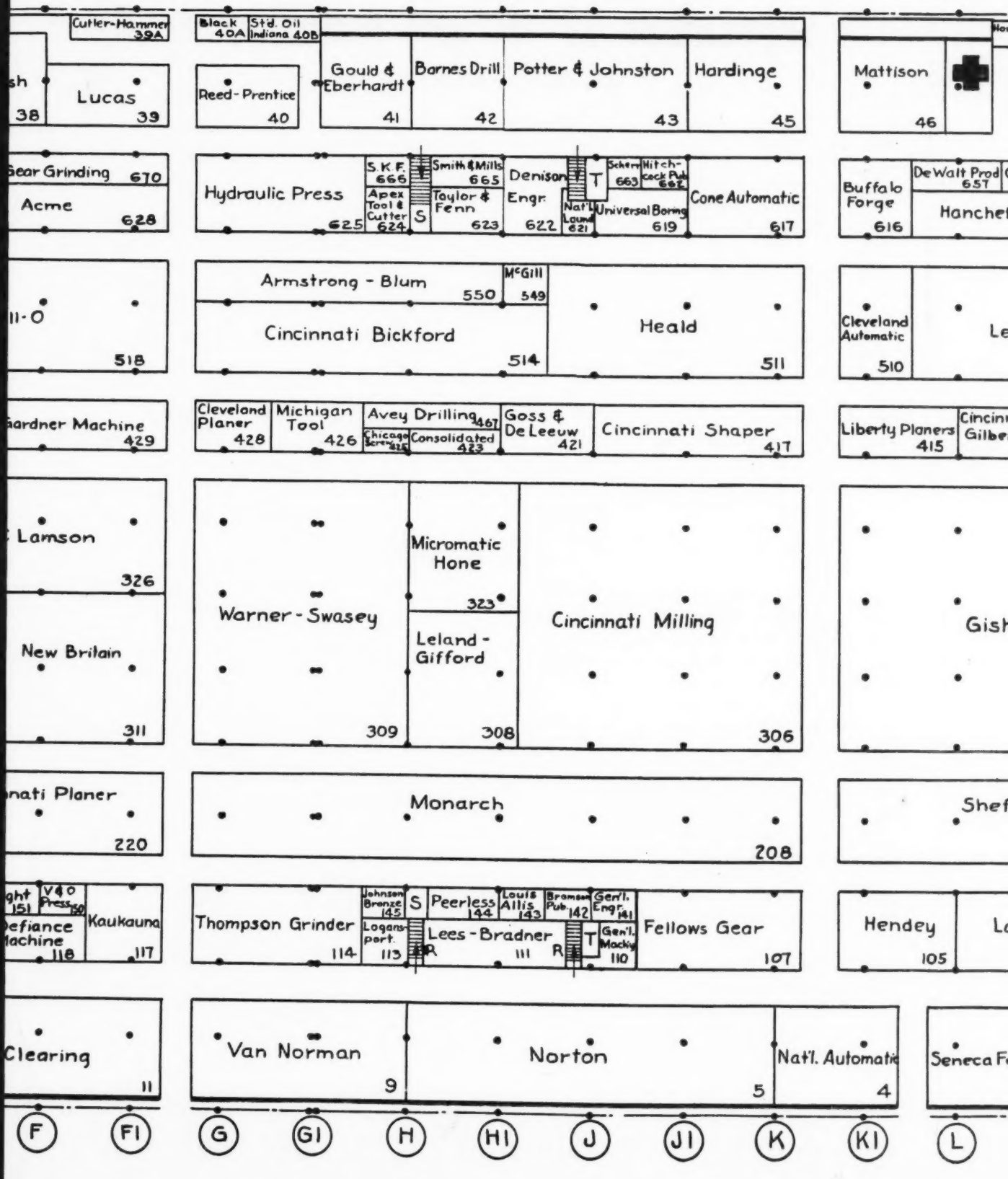
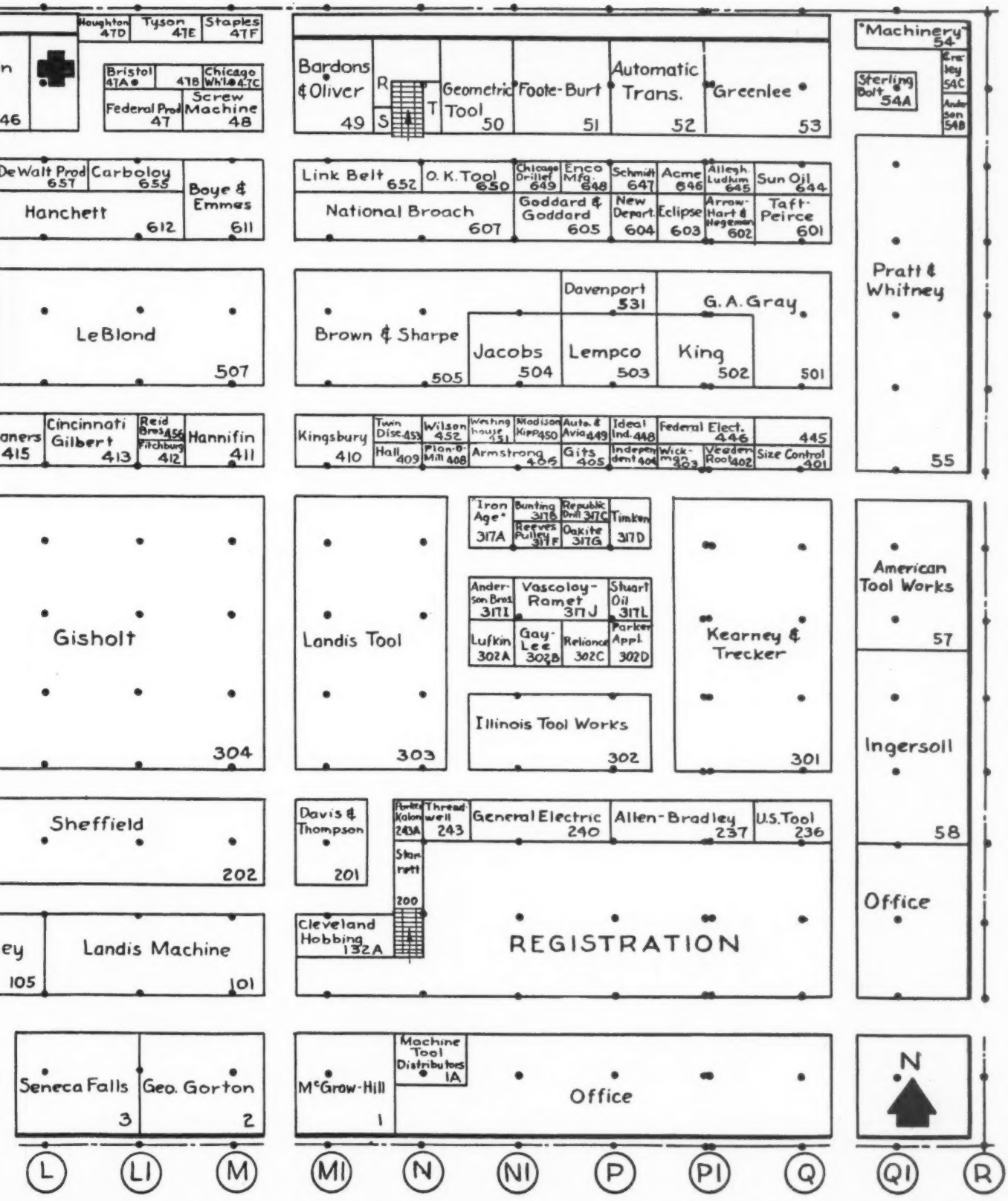


September 17 to 26



Booth No.	Exhibitor
126	Abrasive Machine Tool Co.
571	Acme Equipment Co., Inc.
646	Acme Industrial Co.
673	Ahlberg Bearing Co.
33 E	Aircraft-Marine Products, Inc.
640	Ajax Mfg. Co.
645	Allegheny Ludlum Steel Corp.
237	Allen-Bradley Co.
143	Louis Allis Co.
22	American Broach & Machine Co. Div. Sundstrand Machine Tool Co.
47 B	American Machine & Foundry Co., Wahlstrom Tool Division
57	American Tool Works Co.
328 I	Ampco Metal, Inc.
679	Anchor Coupling Co.
317 I	Anderson Brothers Mfg. Co.
54B	F. E. Anderson Oil Co.
624	Apex Tool & Cutter Co., Inc.
550	Armstrong-Blum Mfg. Co.
406	Armstrong Brothers Tool Co.
602	Arrow-Hart & Hegeman Electric Co.
31	Arter Grinding Machine Co.
52	Automatic Transportation Co.
449	"Automotive & Aviation Industries"
467	Avey Drilling Machine Co.
232	Axelson Mfg. Co.
639	Baker Brothers, Inc.
328 F	Balcrank, Inc.
523	Barber-Colman Co.
49	Bardons & Oliver, Inc.
129	W. F. & John Barnes Co.
42	Barnes Drill Co.
155	Barrett-Cravens Co.
38	Baush Machine Tool Co.
33BB	Bear Mfg. Co.
275	Charles H. Besly & Co.
482	Bijur Lubricating Corporation
40 A	Black Drill Co.
226	Blanchard Machine Co.
633	Bodine Corporation
611	Boye & Emmes Machine Tool Co.
142	Bramson Publishing Co.
313	Bridgeport Safety Emery Wheel Co.
47 A	Bristol Co.
505	Brown & Sharpe Mfg. Co.
525	Bryant Chucking Grinder Co.
616	Buffalo Forge Co.
158	Buhr Machine Tool Co.
314	Bullard Co.
317 B	Bunting Brass & Bronze Co.
655	Carboloy Company, Inc.
36	Carborundum Co.

Booth No.	Exhibitor
225	Carlton Machine Tool Co.
36 B	Century Electric Co.
649	Chicago Drillet Corporation
35 G	Chicago Rivet & Machine Co.
47 C	Chicago Wheel & Mfg. Co.
425	Chicago Screw Co.
514	Cincinnati Bickford Tool Co.
413	Cincinnati Gilbert Machine Tool Co.
522	Cincinnati Lathe & Tool Co.
306	Cincinnati Milling Machine Co.
220	Cincinnati Planer Co.
417	Cincinnati Shaper Co.
14 A	Clark Controller Co.
11	Clearing Machine Corporation
123	Cleereman Machine Tool Co.
510	Cleveland Automatic Machine Co.
132 A	Cleveland Hobbing Machine Co.
428	Cleveland Planer Co.
328 E	Commander Mfg. Co.
617	Cone Automatic Machine Co.
683	Conover-Mast Corporation
423	Consolidated Machine Tool Corp.
636	Covel Mfg. Co.
54 C	C. C. Craley Mfg. Co.
271	Cushman Chuck Co.
39 A	Cutler-Hammer, Inc.
531	Davenport Machine Tool Co., Inc.
201	Davis & Thompson Co.
14 C	Dayton Rogers Mfg. Co.
328 G	Dayton Rubber Mfg. Co.
118	Defiance Machine Works, Inc.
622	Denison Engineering Co.
527	DeVlieg Machine Co.
37	DoAll Co.
34 A	Dore Mfg. Co., Inc.
36 A	Dow Corning Corporation
160	Eastern Machine Screw Corp.
603	Eclipse Counterbore Co.
35 E	Elgin National Watch Co.
648	Enco Mfg. Co.
37 B	Everede Tool Co.
518	Ex-Cell-O Corporation
438	Fafnir Bearing Co.
446	Federal Electric Products Co.
47	Federal Products Corporation
107	Fellows Gear Shaper Co.
35 D	Felters Co., Unisorb Division
412	Fitchburg Engineering Corp.
564	Fitchburg Grinding Machine Corporation
51	Foote-Burt Co.
15	Fosdick Machine Tool Co.
33 C	Furnas Electric Co.

Exhibitors at the Machine Tool Show Dodge-Chicago Plant, Chicago, Ill. September 17 to 26, Inclusive

(Corrected to July 1)

Booth No.	Exhibitor
230	Gallmeyer & Livingston Co.
429	Gardner Machine Co.
566	Gardner Publications, Inc.
302 B	Gay-Lee Co.
670	Gear Grinding Machine Co.
240	General Electric Co.
110	General Machinery Corporation
50	The Geometric Tool Company
315	Giddings & Lewis Mach. Tool Co.
304	Gisholt Machine Co.
405	Gits Brothers Mfg. Co.
330	Gleason Works
605	Goddard & Goddard
2	George Gorton Machine Co.
421	Goss & deLeeuw Machine Co.
41	Gould & Eberhardt, Inc.
501	G. A. Gray Co.
53	Greenlee Brothers & Co.
409	Hall Planetary Co.
612	Hanchett Mfg. Co.
411	Hannifin Mfg. Co.
441	Hanson-Whitney Machine Co.
45	Hardinge Brothers, Inc.
675	R. G. Haskins Co.
511	Heald Machine Co.
105	Hendey Machine Co.
131	Henry & Wright Mfg. Co.
662	Hitchcock Publishing Co.
33 D	Holo-Krome Screw Corporation
47 D	E. F. Houghton & Co.
433	Hyatt Bearings Division General Motors Corporation
625	Hydraulic Press Mfg. Co.
328 C	Hy-Level Screw Products Co.
448	Ideal Industries, Inc.
35 H	Illinois Gage Co.
302	Illinois Tool Works
404	Independent Pneumatic Tool Co.
58	Ingersoll Milling Machine Co.
317 A	"Iron Age"
504	Jacobs Mfg. Co.
313 C	Chas. L. Jarvis Co.
145	Johnson Bronze Co.
326	Jones & Lamson Machine Co.

Booth No.	Exhibitor
35 C	Kane & Roach, Inc.
117	Kaukauna Machine Corporation
301	Kearney & Trecker Corporation
570	Kennametal, Inc.
432	Kent-Owens Machine Co.
502	King Machine Tool Co.
410	Kingsbury Machine Tool Corp.
151	W. B. Knight Machinery Co.
101	Landis Machine Co.
303	Landis Tool Co.
434	Langelier Mfg. Co.
642	Lapointe Machine Tool Co.
157	LaSalle Steel Co.
507	R. K. LeBlond Machine Tool Co.
111	Lees-Bradner Co.
268	Lehmann Machine Co.
308	Leland-Gifford Co.
503	Lempco Products, Inc.
415	Liberty Planers, Inc.
35 B	Lift Trucks, Inc.
652	Link-Belt Co.
312	Lodge & Shipley Co.
113	Logansport Machine Co., Inc.
153	Lovejoy Tool Co., Inc.
39	Lucas Machine Tool Co.
302 A	Lufkin Rule Co.
54	MACHINERY
328 D	Macklin Co.
450	Madison-Kipp Corporation
35 A	Mall Tool Co.
156	Marlin-Rockwell Corporation
328 H	Master Mfg. Co.
14 B	Matco Tool Co.
46	Mattison Machine Works
549	McGill Mfg. Co., Inc.
1	McGraw-Hill Publishing Co.
426	Michigan Tool Co.
323	Micromatic Hone Corporation
128	Moline Tool Co.
208	Monarch Machine Tool Co.
120	Morton Mfg. Co.

Booth No.	Exhibitor
628	National Acme Co.
4	National Automatic Tool Co., Inc.
607	National Broach & Machine Co.
621	National Industrial Launderers and Cleaners Association
17	National Machinery Co.
311	New Britain-Gridley Machine Division New Britain Machine Co.
604	New Departure Division General Motors Sales Corporation
37 A	C. A. Norgren Co.
313 A	Norma-Hoffmann Bearings Corporation
5	Norton Co.
317 G	Oakite Products, Inc.
440	Oilgear Co.
650	O.K. Tool Co.
435	Oliver Instrument Co.
13 A	O'Neil-Irwin Mfg. Co.
37 D	Orlandi Gear & Machine Co.
634	Oster Mfg. Co.
302 D	Parker Appliance Co.
243 A	Parker-Kalon Corporation
144	Peerless Machine Co.
30	Penton Publishing Co.
563	Physicists Research Co.
18	Pines Engineering Co., Inc.
35 F	Pioneer Pump & Mfg. Co.
408	Plan-O-Mill Corporation
442	Portman Machine Tool Co., Inc.
43	Potter & Johnston Machine Co.
55	Pratt & Whitney Div. Niles-Bement-Pond-Co.
37 C	Precise Products Co.
328 B	PurOlator Products, Inc.
443	Racine Tool & Machine Co.
40	Reed-Prentice Corporation
317 F	Reeves Pulley Co.
233	Rehnberg-Jacobson Mfg. Co.
456	Reid Brothers Co., Inc.
302 C	Reliance Electric & Engineering Co.
317 C	Republic Drill & Tool Co.
28	Rivett Lathe & Grinder, Inc.
526	Rockford Machine Tool Co.
641	Rodgers Hydraulic, Inc.
13 B	Roller Bearing Co. of America
313 B	Ross Operating Valve Co.
34 E	Royal Oak Tool & Machine Co.
663	George Scherr Co., Inc.
647	George T. Schmidt, Inc.
48	Screw Machine Publishing Co., Inc.
3	Seneca Falls Machine Co.
33 B	Severance Tool Industries, Inc.
202	Sheffield Corporation
16	Sidney Machine Tool Co.
401	Size Control Co. Division American Machine & Gage Co.
666	S K F Industries, Inc.
638	Skinner Chuck Co.
665	Smith & Mills Co.
33	Socony-Vacuum Oil Co., Inc.
436	Springfield Machine Tool Co.
678	Square D Co.—Ind. Controller Div.
40 B	Standard Oil Co. (Indiana)
47 F	Staples Tool Co.
200	L. S. Starrett Co.
677	Stearns Magnetic Mfg. Co.
54 A	Sterling Bolt Co.
317 L	D. A. Stuart Oil Co., Ltd.
20	Sundstrand Machine Tool Co.
21	Sundstrand Hydraulic Division
644	Sun Oil Co.
676	Super Tool Co.
34 B	Synthane Corporation
601	Taft-Peirce Mfg. Co.
623	Taylor & Fenn Co.
13 C	Texas Co.
33DD	Thomas Hoist Co.
114	Thompson Grinder Co.
317 D	Timken Roller Bearing Co.
35 I	"The Tool Engineer"
453	Twin Disc Clutch Co.
47 E	Tyson Bearing Corporation
125	Union Mfg. Co.
34	U. S. Electrical Motors, Inc.
236	U. S. Tool Company, Inc.
619	Universal Boring Machine Co.
150	V & O Press Co., Division Rockwell Mfg. Co.
9	Van Norman Co.
317 J	Vascoloy-Ramet Corporation
402	Veeder-Root, Inc.
228	Vickers, Inc.
224	Vinco Corporation
154	Wallace Supplies Mfg. Co.
309	Warner & Swasey Co.
328 A	Warner Electric Brake Mfg. Co.
483	Weddell Tools, Inc.
451	Westinghouse Electric Corp.
403	Wickman Corporation
32	Wiedemann Machine Co.
452	Wilson Mechanical Instrument Co.
35 J	Wilton Tool Mfg. Co.

Map Out Your Visit to the Show!

VACATIONISTS about to start on a motor trip into unfamiliar regions would hesitate to commence their journey without first consulting a road map to determine how all points of interest can be visited most advantageously. Prospective visitors to the Machine Tool Show, to be held at the Dodge-Chicago plant, Chicago, Ill., from September 17 to 26, should find a preliminary floor plan of the Show equally valuable as a "map" of the several hundred exhibits. For the convenience of prospective visitors, a Show floor plan is inserted opposite this page.

Visitors who can take in every exhibit will be amply repaid for the time spent in increased knowledge about latest manufacturing practices. They can use this Show map now to schedule their daily "itineraries" most effectively and thus insure a visit to each exhibit. Less fortunate visitors who can spend only one or two days at the Dodge-Chicago plant will find the floor plan especially useful for "spotting" ahead of time the exhibits which they think will be of the greatest importance to them. Little time need then be consumed upon arriving at the Show in determining where specific exhibits are located and planning visits to them.

The floor plan shows at a glance the magnitude of the Show. There will be about 275 exhibitors and their exhibits will cover 500,000 square feet of floor space, or nearly 12 acres. The total value of the two thousand or more machines on display will be about $16,000,000. Seven machines to be presented by one manufacturer will weigh 400,000 pounds and have a value of $325,000. Practically all machines will be seen in actual operation. Never before has there been such a complete exhibition by one basic industry.

Every manufacturer who wants to produce more goods at less cost in order to maintain and expand his market should not miss this chance to let his production men become acquainted with the latest developments in machine tools.

Charles O. Herb

Planning and Installing an

COMPRESSED air is a major industrial power, possessing many advantages. It is safe, flexible in application, and easily transmitted. The total cost of doing a given job by air includes labor, burden, amortized cost of the tool with its repair and maintenance, and cost of the compressed air. It has been demonstrated many times that the cost of labor plus burden is more than 95 per cent of the total cost of the operation; therefore, the cost of the compressed air and the tool itself is insignificant compared with the value of the work it performs.

In order to obtain the advantages of compressed air, planning is essential. To achieve the savings and results expected, care must be exercised in the selection of the equipment, in its installation, and in laying out the distribution system. Some of the important points to consider in planning a compressed-air installation will be discussed in this article.

A compressed-air system consists of one or more compressors, each with driver, control or regulation, intake air filter, after-cooler, air receiver, and interconnecting piping, together with a distribution system to carry the air to points of use. A typical, small compressed-air system is shown in Fig. 1. The object of a compressed-air installation is to provide sufficient quantity of air to the work at sufficient pressure for efficient operation. Before attempting to determine the amount of compressed air necessary, a thorough study should be made of all the applications for which air power may be suitable.

The information obtained from such a study will then become basic in approaching the problem of engineering the installation in any particular plant. In working out an installation, a series of analyses is recommended. These include (1) necessary compressor capacity; (2) number of compressor units; (3) location of compressor units; (4) regulation of compressed-air system; and (5) distribution system.

Necessary Compressor Capacity

A study of air-operated devices in a typical plant will show that while many of these devices operate almost continuously, there are others that operate infrequently but require a relatively large air supply when in use. It will also be found that the amount of air used by the individual device will vary considerably in different applications.

Therefore, the average air consumption of air-operated tools should be ascertained in determining the required compressor capacity. This may

Efficient Compressed-Air System

Information on Compressor Capacity Required, Location and Regulation of Compressor Units, Distribution Systems, and Types of Compressors. Abstracted from a Compressed Air Handbook, Compiled and Edited by the Compressed Air and Gas Institute, which is Soon to be Published by the Institute

be obtained from manufacturers' literature or may be closely approximated by actual test. Care must be taken not to assume that air-operated devices consume their maximum under all conditions. The load factor of the device must be considered.

Relatively few air-powered devices use air continuously. Pneumatic tools of all types—hoists, blow-guns, etc.—operate intermittently, and their net air consumption is considerably less than their maximum. The ratio of actual air consumption to the maximum continuous full-load air consumption is known as the load factor.

Two items are involved in the load factor. The first is the time factor, or percentage of total time that the device actually uses air. The second item depends on what might be called the "work factor," or the per cent of maximum possible work output per minute actually done by the device. For example, the air consumption of a grinder with full open throttle varies considerably, depending upon how hard the operator pushes it against the work. The work factor is, therefore, the ratio of the air consumption under the actual conditions of operation to the air consumption when the tool is fully loaded.

In a study of thirty-four separate portable tools used on production work in one shop, the actual air consumed was only 15 per cent of the full-time rated air requirements. In another large shipyard with several thousand portable tools, the actual load was only 7.6 per cent of the load that might be expected, based on the total tools in operation plus stock and reserves. In determining the load factor, care should be taken not to consider the tools in the store-room or not in use.

The foregoing applies only to the more steadily operated air tools and appliances. A study of the uses of air power that cause heavy but usually short-time demands will show the added capacity required for these operations. The possibility of storing air in large receivers should be considered, although this can be helpful only to provide for peak demands of very short duration.

Some comment should be made on the costly, yet common, practice of adding a percentage to the calculated compressor capacity to provide for piping leakage. This has been due largely to the fact that compressed air is so harmless that it is not considered vitally necessary for an air system to be tight. There is no more justification for allowing compressed-air wastage than there is for buying a compressor without capacity control, letting it operate continuously at full capacity, and discharging the surplus through relief valves to the atmosphere. It is customary practice to add about 10 per cent for leakage. However, air lines can be made just as tight as other piping systems, and can be kept tight. It pays to do this.

Before determining the final compressor capacity, consider carefully that once compressed air is available, its versatility will lead to a magnitude of profitable uses and applications not originally anticipated. Although mechanically it is no problem to increase the size of a compressed-air installation, since any number of units can discharge into the same system, it is prudent to provide some excess capacity, including the piping system, for future growth when the original plans are made. What this excess capacity should be depends largely on individual conditions and total known requirements.

It is less difficult to arrive at the capacity needed for a plant extension than for a new installation. Local experience, compressor load factors, tool load factors, etc., either known or readily determined, provide a sound basis for decision. The most frequent indication that more compressor capacity is needed is low air pressure, which reduces shop production alarmingly.

Based on a careful record of the pressures throughout the production areas, present compressor operating load factors, and peaks in demand (periods of unusually low air pressure),

it is possible to determine with reasonable accuracy the additional compressor capacity required to maintain full air pressure at the working positions and thus increase tool effectiveness and production to the maximum. In all calculations, compressed-air measurement should be in terms of cubic feet per minute of actual free air.

Number and Location of Compressor Units

The number of units into which the total capacity should be divided is important. Air compressors are sturdy machines, but like all mechanical and electrical equipment, they require maintenance and must occasionally be taken out of service. The compressed-air supply during maintenance periods is provided for differently in almost every plant. If the supply of compressed air is vital to continued production, the number of maintenance units is usually determined by a comparison of the cost of standby capacity with the value of the production loss. Many plants require a relatively small volume of air continuously, even when the pneumatic equipment is not in production. A small unit of proper size to take care of such requirements over weekends, holidays, etc., is often desirable.

The location of a compressed-air system with relation to the points where the air is used should be given some study. A central plant housing all the compressors has advantages in unified operation and care, better supervision, and probably less labor cost. In a central plant, it is probable that no more compressors will be kept operating than are necessary to maintain pressure. The load factor and operating efficiency of each unit will, therefore, tend to be relatively high.

It is possible, however, that a central plant cannot be so located that satisfactory distribution of air and maintenance of pressure can be obtained without excessive piping costs. In such a case, it may be better to divide the compressor plant into two or more installations at or near specific load centers, interconnecting the piping so that air can be distributed either way to meet peak-load requirements. Of course, the equipment should be placed as close as possible to the larger load centers. This reduces piping costs, and results in higher pressure at the tools, with closer control of the pressure.

Regulation of Compressed-Air System

Since the demand for compressed air usually varies widely from time to time, some form of capacity control is required. Two general methods are available. The first—known as speed and pressure regulation—varies the speed of the compressor according to the demand for air, as is usually done in a steam-driven compressor.

The second—known as constant-speed regulation—operates the compressor at a constant speed and varies the capacity by any one of several types of unloading systems, as is usually done in a motor-driven compressor. For general industrial use, control of pressure closer than a 5 per cent range between full load and no load is unnecessary and should be avoided. Much

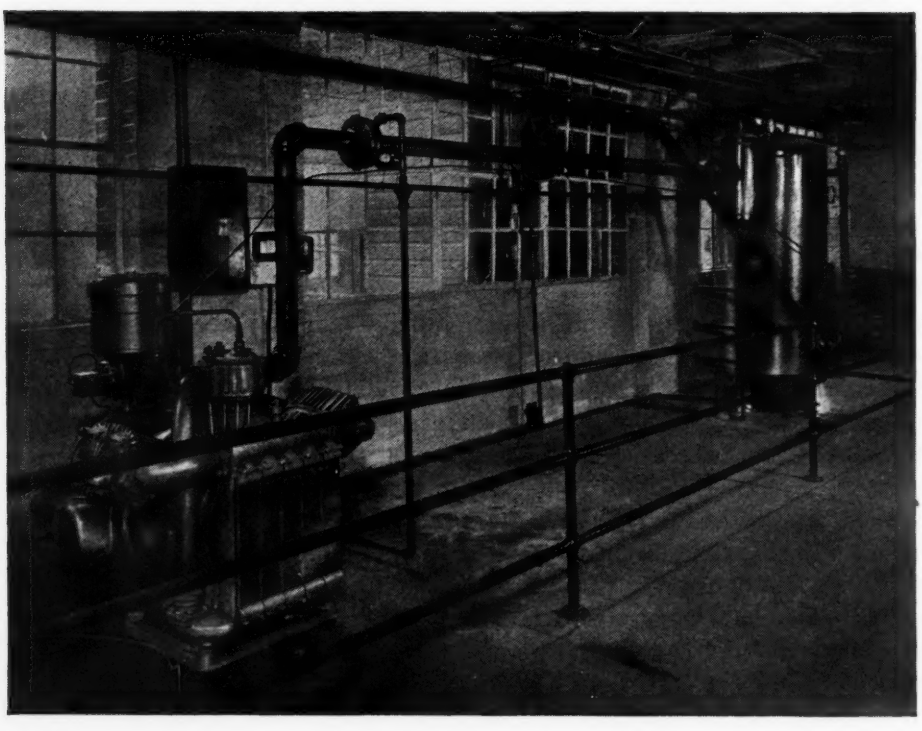


Fig. 1. Small Compressed-air System, Consisting of Two-stage, Air-cooled Compressor, Driver, Filter, Pipeline Type Aftercooler, and Receiver.

closer regulation of the pressure can be provided when special conditions require it.

Wherever possible, pressure regulators should be so selected and adjusted that the large units will act as base load units and unload only after the smaller units have been shut down. When the requirements have diminished to where they can be handled by one of the smaller units, the large unit should be shut down. In this way, the over-all economy will be improved.

Compressed-Air Distribution System

Any drop in pressure between the compressor and the point where the compressed air is used is irrecoverable loss. The distribution system is, therefore, one of the most important elements of the compressed-air installation. In planning it, the following general rules should be observed.

Pipe sizes should be large enough so that the pressure drop between the receiver and the point of use will not exceed 10 per cent of the initial pressure. Provision should be made not only for present air capacity but also for reasonable future growth. When possible, a loop system should be employed around the plant and within each shop and building. This gives a two-way distribution to the point where the air demand is greatest.

Long distribution lines should have liberal sized receivers located near the far ends or at the points of occasional heavy use. Many peak demands for compressed air are instantaneous and relatively short, and storage capacity near such points avoids excessive drop. Frequent outlets should be provided on each header or main for attaching hose for air-operated equipment, and the outlet should always be put at the top of the pipe line to prevent condensed moisture being carried over to the tool. Frequent outlets result in shorter hose length and, therefore, less pressure drop through the hose.

All piping should be arranged so that it slopes toward a drop leg or moisture trap, in order that condensed moisture can be removed from the piping system and will not be carried over to the air tools or compressed-air operated devices, where it is very harmful. In planning the distribution system, it should be remembered that over-size piping costs little more than smaller size, as most of the initial expense is for labor.

Selection of Type of Compressor

The selection of the particular type of compressor to be used—reciprocating, rotary, or centrifugal—should be based on consultation with various manufacturers whose engineers are best qualified to make such recommendations. A choice between single- and two-stage compression depends on many widely varying factors, such as size of cylinders, speed of unit, ratio of compression, discharge temperature limitation, cost of power, continuity of service, method of cooling, permanence of installation, etc. In general, the dividing line between single- and two-stage air compression for double-acting compressors may be drawn as follows, assuming sea level and atmospheric intake conditions: For pressures below 60 pounds per square inch, single-stage; for pressures above 100 pounds per square inch, two-stage; and for the range between 60 and 100 pounds per square inch, single-stage for capacities below 300 cubic feet per minute, and two-stage for larger sizes.

Before finally deciding upon the precise type of compressor to be installed, consideration should also be given to the various types of power used to drive compressors—electricity, steam, oil, gas, or gasoline. The type of drive deserves careful study from the standpoint of first cost, operating cost, reliability of power or fuel supply, and maintenance. Anticipated load factor will also occasionally have a bearing on the selection.

Compressor Accessories

The air receiver is an essential part of every air-compressor installation. It absorbs pulsations in the discharge line from the compressor, insuring a steady flow of air to the service line. It also acts as a reservoir for the storage of compressed air, and furnishes reserve capacity to take care of sudden and unusual momentary demands in excess of the capacity of the compressor. Another of its functions is to precipitate moisture in the air coming from the compressor, or moisture that may be carried over from the aftercooler.

Aftercoolers are an essential part of nearly every compressed-air installation. Compressed air or gas always contains moisture to some degree, depending on the condition of the air taken into the compressor and on the system of compression. This moisture, because of the heated condition of the air or gas as it leaves the compressor, is carried along as vapor through the receiver and into the pipe line. When the pipe lines are long, considerable heat loss takes place, and the moisture-carrying capacity of the air or gas is reduced to such an extent that moisture is precipitated.

Water and oil vapor must be condensed to be

removed, and it is necessary to cool the compressed air or gas for this purpose. Aftercoolers are used to accomplish this. They consist essentially of steel shells containing a nest of tubes through which water circulates, the air or gas passing around the tubes. By cooling the air or gas to approximately the temperature at which it enters the compressor, most of the vapor is condensed and can be separated before it enters the service lines. A moisture separator is an essential part of an efficient aftercooler. An automatic moisture trap is also recommended.

A compressor must be furnished with filtered air or gas to insure satisfactory operation. If dust or other foreign matter is continually sucked into a machine, it causes rapid wear of the working parts and forms an obstructive coating on the cylinder, valves, etc. To avoid such a condition, air filters should be attached to air compressors and scrubbers to gas compressors.

When the noise usually made by the suction of the compressor or the noise occasionally encountered in compressor discharge lines is objectionable, a silencer should be used. The silencer should not offer resistance to the air flow exceeding 2 inches of water.

* * *

Better tools and equipment do not spring full blown out of the mind and hands of one man. They are the product of long hours of research and of the painstaking application of such knowledge to the design and production of better products by competent management.—*C. E. Wilson, President, General Motors Corporation*

Production and Machine Tool Show at Chicago International Amphitheater

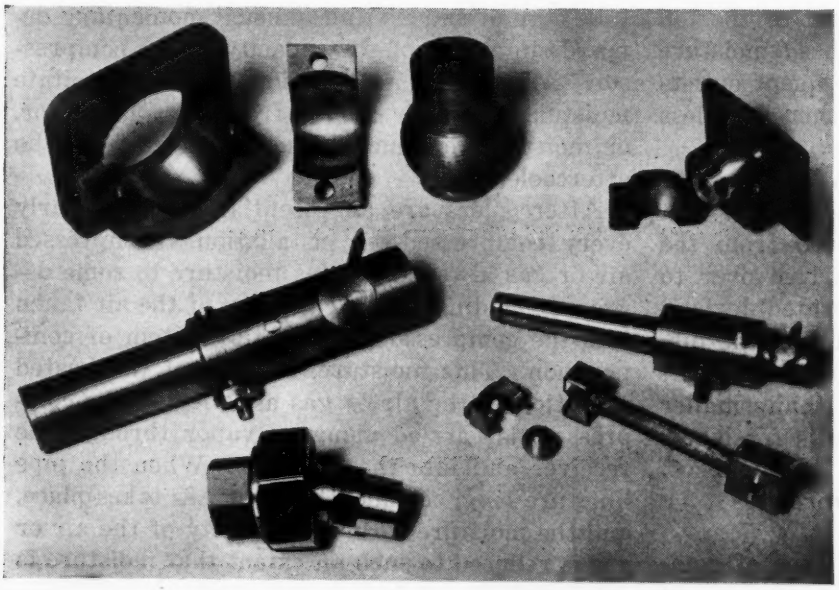
Announcement has been made of a Production and Machine Tool Show to be held at the International Amphitheater, 42nd and Halsted Sts., Chicago, Ill., from September 17 to 26, inclusive, at which machine tools, other production machinery, and accessories will be exhibited. The Show is open to both American and foreign exhibitors. The Amphitheater has 143,000 square feet of floor space available for exhibition purposes. Approximately 75 per cent of the space identified as the "arena" had been reserved up to July 1. Among the first companies to sign up for space are: Canedy-Otto Mfg. Co., Cosa Corporation, Crystal Lake Grinders, DoAll Co., R. E. Ellis Engineering Co., Greenerd Arbor Press Co., Grob Brothers, Hobart Brothers, Johnson Machine & Press Corporation, H. Leach Machinery Co., Lincoln Electric Co., Moore Special Tool Co., Porter-Cable Machine Co., Ruthman Machinery Co., Sheldon Machine Co., Walker-Turner Co., Wiedemann Machine Co., and Marcel Pegard of Paris, France.

Complete information can be obtained from the Production and Machine Tool Show, 3 Bridge St., Grafton, Wis.

* * *

Internal Radius Boring Tools

The accompanying illustration shows two internal radius boring tools of different sizes and a few samples of parts machined by them, including two self-aligning bearings or pillow blocks of different sizes; a self-aligning connecting-rod which, if cut in half, would be the equivalent of two rod ends; and a self-aligning pipe union designed to protect the threads from being crossed during assembly. These internal radius boring tools have been designed by the McKenzie Engineering Co., Newtown, Conn., and can be made to fit the taper of a lathe tailstock or to be held between lathe centers or in a turret lathe. They are said to have easily operated feeds which insure smoothly finished radius-formed surfaces.



Internal Radius Boring Tools and Examples of Work

Need for Realistic Depreciation of Machine Tools

(Continued from page 137)

where they could improve their facilities by having sufficient cash reserves each year to buy new machines to the extent of their investment in machine tools the previous year. Sweden allows free choice of depreciation, and this policy is resulting in the building up and modernizing of Sweden's industrial facilities. Sweden will be tough competition in the world market. The privilege Hitler allowed German industry before the war of writing off capital investments as expense after a minimum corporation income tax, helped to build up German industry from being flat on its back in 1932 to a point where it was so modern and efficient that Germany could show the world something about mechanized warfare.

It might be to our national interest to take a few pages out of their book and consider whether free choice of depreciation allowance might not be what this country needs. It would modernize and make our industrial plants more efficient. It might compensate for the much higher labor rates here than in other countries. It might help to keep our national income on a high level and keep taxes down; and it might improve our standard of living by making it possible to produce more goods for more people at lower cost.

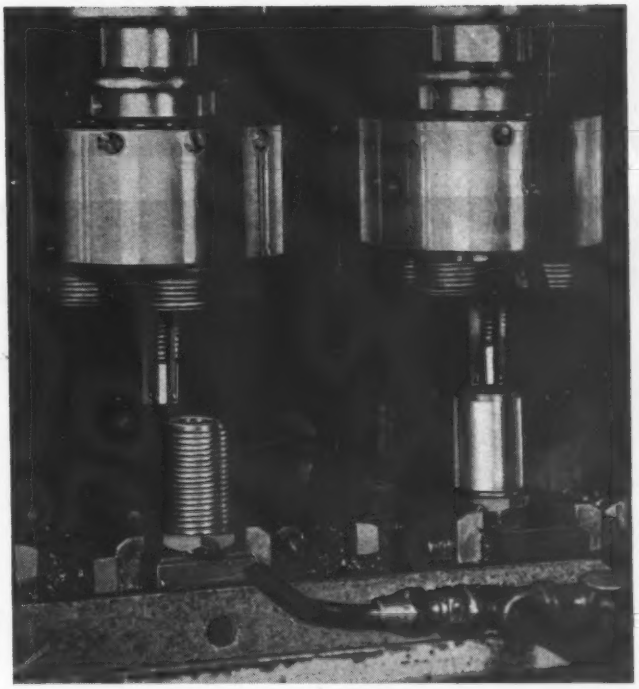
* * *

Illinois Tool Works Celebrates Thirty-Fifth Anniversary

The Illinois Tool Works, Chicago, Ill., manufacturers of metal-cutting tools, Shakeproof fastening products, and Illitron electronic heating equipment, recently celebrated the thirty-fifth anniversary of the founding of the company at a dinner meeting in Chicago. Special ceremonies featured the recognition of fifty-four employes who have completed twenty-five or more years of service with the organization.

* * *

More than $160,000 worth of surplus machine tools were given to schools and municipalities of five states recently during the War Assets Administration's inauguration of the machine tool donation program at the Nash-Kelvinator plant, Kenosha, Wis. Agencies that receive machine tool donations need only pay skidding, packing, crating, loading, and shipping costs.



The Simultaneous Tapping and Threading of Steel Bushings with the Set-up Here Shown on a Ten-spindle Multiple Drilling Machine has Materially Increased Output in an Automotive Parts Plant

Simultaneous Internal and External Threading of Steel Bushings Reduces Production Time

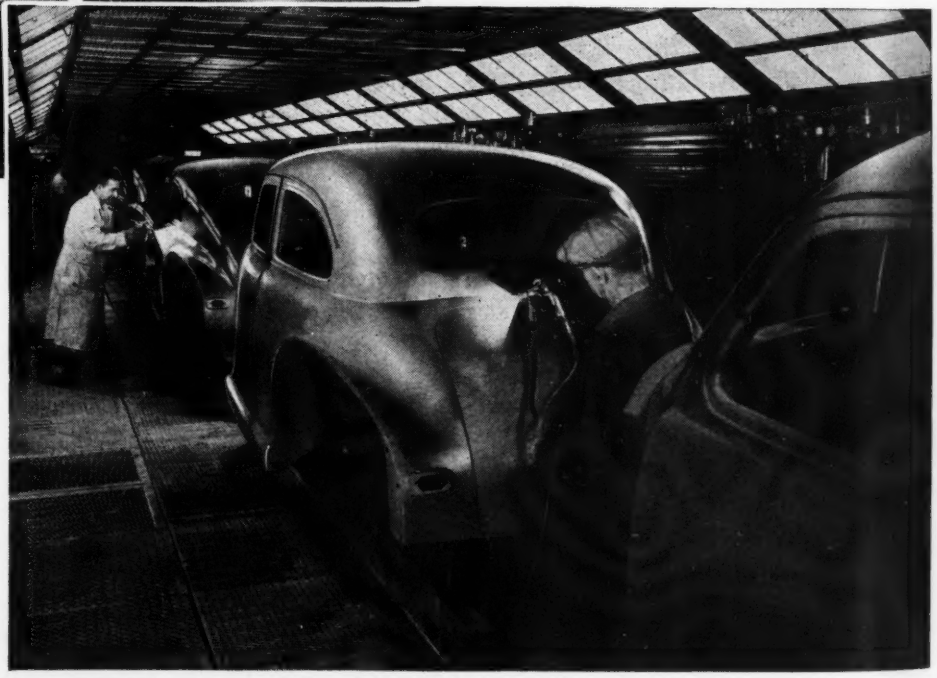
Approximately 1100 bushings for shock absorbers and knee-action assemblies are being threaded per hour in an automotive parts plant by simultaneously cutting the internal and external threads on a ten-spindle multiple drilling machine. As shown in the illustration, the internal thread is machined with a tap having a pilot to secure correct alignment, while the external threads are cut with chasers that revolve with the spindle. The taps, which are a product of the Detroit Tap & Tool Co., Detroit, Mich., are made of chromium-cobalt high-speed steel. They are held in the die-heads by means of opposing lock-screws.

The bushings, which range in size from 1 1/8 to 1 1/2 inches outside diameter, 11/16 to 7/8 inch inside diameter, and 1 1/2 to 3 inches in length, are made of cold-rolled steel. They are slid into the fixture of the machine with the hexagonal end down so that the torque can be taken on the hexagon; the thrust of the taps holds the bushings down.

In operation, the fixture is cleared of chips by an air jet, and curtains attached to each spindle head travel up and down with the ram to protect the operator from oil spray.

Operations in a New Chevrolet-

APPROXIMATELY forty-three acres of floor space devoted exclusively to body and car assembly have been added to the production facilities of the automotive industry with the completion of the new Chevrolet-Fisher Body plant at Flint, Mich. The plant consists of two units—the first of two projected plants of the Chevrolet Motor Division of the General Motors Corporation, and the Flint No. 2 plant of the Fisher Body Division. The plant is designed to produce a



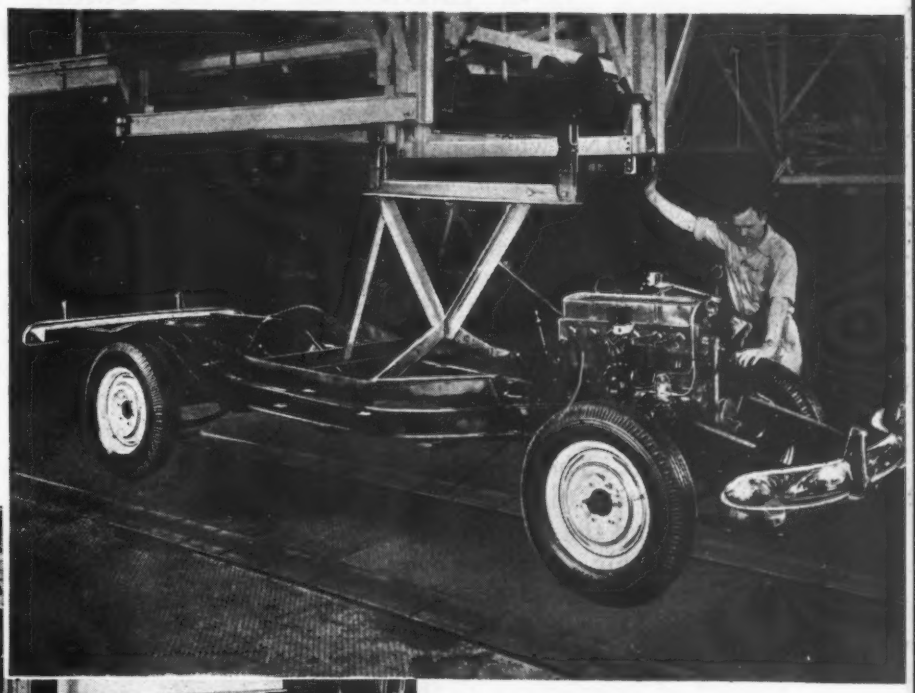
(Above) In the Fisher Body Section, a "Balloon" Assembly, Consisting of the Roof, the Rear Quarter, and Tail Panels of a Body, is Lowered on the Floor Pan, to which the Front End Assembly has been Attached. Next, Sub-assemblies are Joined by Welding, Using Suitable Locating Fixtures

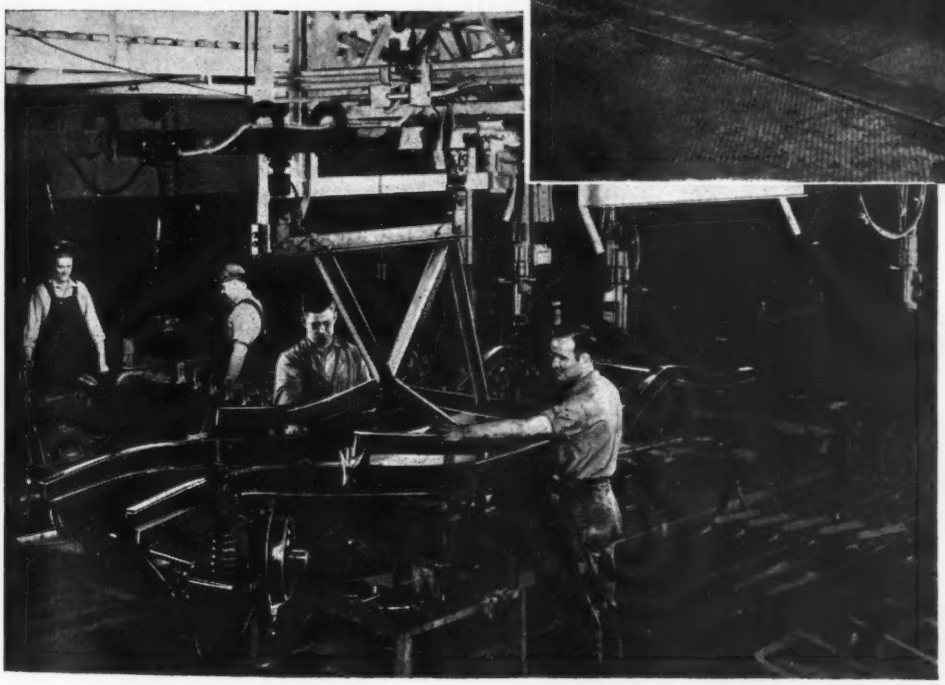
(Above) An Outstanding Innovation is Found in the Paint Spray Booths. By a Unique System of Air and Water Ventilation, Paint Fumes are Immediately Carried away and Employes can Work in the Spray Booths without the Respiratory Protection Usually Necessary on Such Jobs

(Left) Grinding, Filing, and Finishing Operations along the Body Conveyor Line. Carriages, which Move on a Conveyor that is Flush with the Floor Level, Convey the Bodies all the Way through the Assembly and Trim Departments

Fisher Body Assembly Plant

car a minute and a truck every three minutes. One of the unique features is "suspended assembly" of car chassis — the first time that such a system has been applied in the high-volume production of automobiles. Overhead conveyors carry the automobile frames at bench level, permit right-side-up assembly of the chassis, and allow free access to the assemblies from all sides. The illustrations on these pages show some of the important operations in the new plant.





(Above) Final Assembly of the Car Begins at This Point, where Dual Elevators Drop the Chassis from the "Suspended Assembly" Conveyor to a Floor Conveyor. Chevrolet is the First High-volume Producer of Automobiles to Use Overhead Conveyors for Chassis Assembly

(Above) An Automobile Frame Starts down the Assembly Line in Chevrolet Plant. The Frame is Hoisted by an Elevator and Picked up by a "Power and Free" Overhead Conveyor, on which the Assembly is Free at Key Locations to Permit being Pushed by Hand

(Right) Dropping a Body on a Chassis along One of the Chevrolet Final Assembly Lines. Two Lines Progress from Dual Body Drop Positions, as More Work is Done after the Mounting of the Body on the Chassis than before. One Chassis Conveyor Supplies Both of These Final Assembly Lines

Grinding Wheels Developed

A Vitrified Bond that Offers a Minimum Amount of Interference to the Cutting Action of the Abrasive is a Feature of a New Line of Grinding Wheels Produced by the Carborundum Co.

GRINDING wheel selection is based on the ability of the wheel to withstand wear or breakdown during the operation of removing stock and to produce the required finish in the shortest possible time. Of the several characteristics that affect wheel performance, bond is one of the most important. It is frequently thought that size and type of grain are the principal factors in determining the finish and stock removal rate, but this is not entirely correct. The porosity and hardness of the wheel and the structural relationship between the grain and the bond are other important factors. Not only must the bond hold the grains together, but it must hold them with the necessary strength and in the proper space relationship. In addition, it must offer a minimum amount of interference to the cutting action of the wheel.

To better meet these various requirements, the Carborundum Co., Niagara Falls, N. Y., has developed an entirely new type of vitrified bond and incorporated it into a line of grinding wheels, known as Series 20, for tool-room and, eventually, production applications.

The nature of the bond is such that more abrasive is exposed to the work. With this reduction in bond interference, the amount of heat generated is reduced, allowing a deeper and faster cut to be made, with longer wheel life. The nature of the bond also allows the use of finer grits with no reduction in stock removal rates.

The results of tests in approximately eight hundred tool-rooms and shops indicate that wheel life with the new bond is from 20 to 50 per cent better than with ordinary bonds. However, as would be expected in any such check, the performance varied with the shop equipment employed and with the technique used, so that this

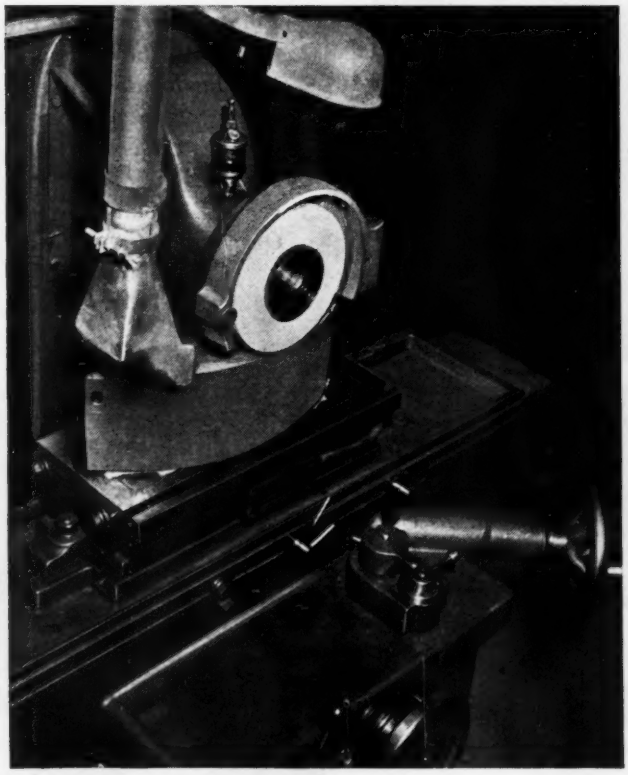


Fig. 1. A Series 20 Wheel being Used to Grind a Cast-iron Machine Part. The Depth of Cut is 0.020 Inch

Fig. 2. The 0.010-inch Cut on This Motor Lamination Die was Taken with a Table Traverse of 35 Feet per Minute

for Wide Application

increase was far exceeded in some cases and not fully realized in others.

Another result, not readily apparent, but of great importance, is the versatility of the new series of wheels. The different classes of work encountered in the average tool-room always has required a great variety of grain sizes, grades, structures, and bond types. The new line materially reduces the number and variety of these requirements, thereby simplifying the users' stocks. In one case, the number of wheels used in a large tool-room was reduced by 50 per cent.

About 70 per cent of surface grinding operations, involving all types of steels, can be done with wheels of three specifications. Wheels of the new series are also used successfully for grinding cast iron. When form grinding is encountered, two additional specifications will meet all requirements.

Actually, there are three major tool-room applications for the line: Surface grinding on horizontal-spindle machines, tool and cutter grinding, and form grinding. Surface grinding wheels are available in diameters ranging from 7 to 12 inches and in grits of 46 and 60. Fig. 1 shows one of these wheels being used to finish-grind a cast-iron machine part. Another even more severe operation—the grinding of a die member for motor laminations—is shown in Fig. 2. This cut was taken with a table traverse of 35 feet per minute and a depth of cut of 0.010 inch.

An equally narrow range of abrasive specifications covers tool and cutter grinding, these wheels being made in 60 and 80 grit. Either straight or flaring cup or saucer type wheels can be applied, depending on the tool being ground. A typical application is illustrated in Fig. 3.

Finally, two of the Series 20 wheels may be applied for rough surface-grinding of forms, such as illustrated in Fig. 4.

The new wheels are available for all types of surface and tool-room grinding and they will probably replace wheels of all other Carborundum bonds for precision tool grinding, with the possible exception of the V10 vitrified bond for form grinding. The fundamental advantages of the line may also carry it into other fields, but this decision must await results from extensive tests now in progress.

Fig. 3. Resharpening a 12-inch Face Milling Cutter. Straight or Flaring Cup or Saucer Type Wheels are Available

Fig. 4. Rough Form-grinding a High-speed Steel Part with New Carborundum Series 20 Grinding Wheel

Advances in Machine Tool Electrification

By PAUL W. ARNOLD
The Reliance Electric & Engineering Co.
Cleveland, Ohio

VISITORS to the Machine Tool Show at the Dodge-Chicago plant in Chicago, September 17 to 26, will see, in actual operation, more than a thousand production machines of the most advanced designs. A substantial number of these machines will be equipped with improved types of electrical drives and controls designed to provide (1) more power; (2) higher machine speeds; (3) greater simplicity of operation; (4) better operating flexibility; and (5) improved reliability, resulting in reduced maintenance time.

Many ingenious methods are utilized for achieving such results. The use of lighter materials and better electrical alloys permits more power to be packed into smaller motor frames. In cases where large amounts of power are required, the motor is connected as directly to the load as possible, eliminating belts, gears, and clutches. An excellent example of this is the reversing planer in which the motor is coupled to the drive-shaft and the drive-shaft is geared (without change-gears) directly to the table.

In other machines, electrification has been used to simplify the transmission of power, especially where relatively high speeds and large amounts of power are required. The vertical-spindle milling machine shown in Fig. 1 has, in addition to variable-voltage drives controlling the spindle speed and the feed and traverse, an electrical transmission. This transmission is housed in a cabinet that can be mounted on the rear of the machine or actually separated from it, as contrasted to a mechanical transmission, which would have to be built into the machine.

High machine speeds also require designs into which safety features can be incorporated, for the redesigned machine is often faster than the operator. The properly designed electric drive centralizes control in one or more stations, which are interlocked for safety. Push-buttons and small levers give the operator complete control of even the highest powered machine tool. Speed changing can also be controlled from the same stations, and the changes are so easy and rapid that they can be made economically even for operations of short duration. The speeds obtainable are infinitely variable — literally stepless in character. These centralized controls make the general-purpose machine semi-automatic and also serve to improve the fully automatic machine.

There have been some comments by shop personnel on the maintenance problem presented by machine electrification. Electric-drive troubles, when they develop, are generally to be found in control

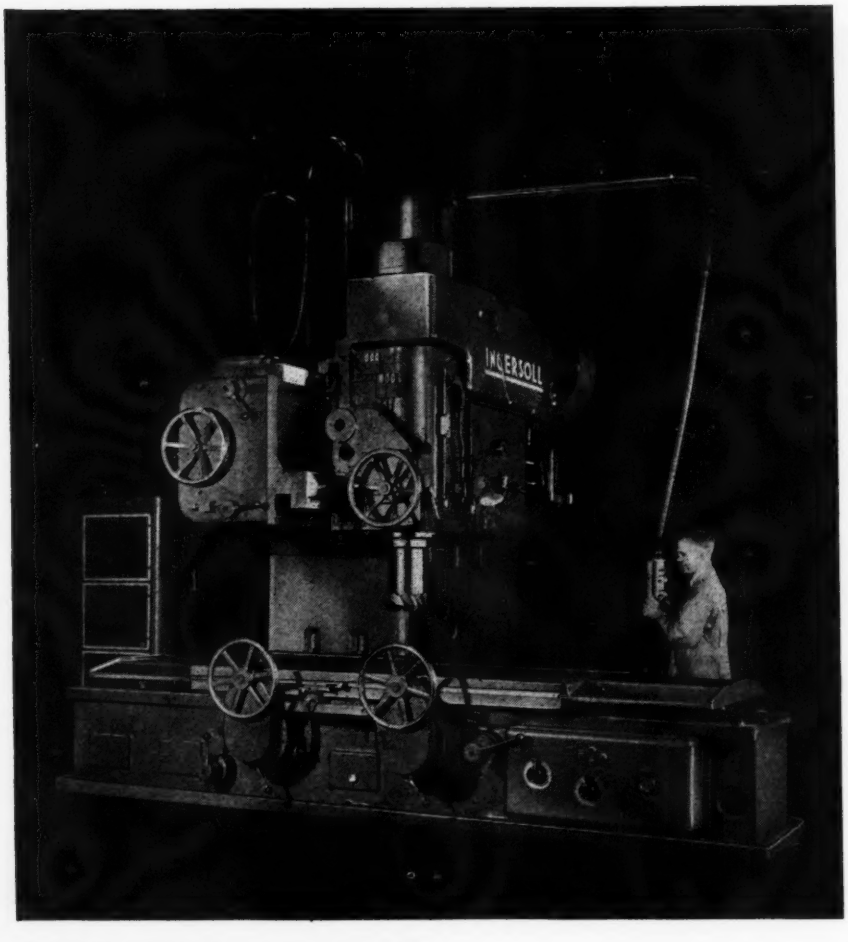


Fig. 1. Ingersoll Vertical-spindle Milling Machine with Variable-voltage Drive for Spindle Speed, Feed, and Rapid Traverse. The Machine also has Electrical Transmission

contacts, springs, coils, electronic devices, and tubes, and in burned out motors, brushes, or bearings. Such electrical troubles are not always readily evident, and many take more time to find than breakdowns in a comparable mechanical or hydraulic system. On the other hand, it is quite generally agreed that they require little time to repair, a fact that results in less maintenance time and less "down time" of the machine.

However, maintenance is of secondary importance in applying a particular type of drive to a machine tool; more important is the ability of the drive to impart the required operating characteristics to the machine. A choice of drives is confined to the following types:

Squirrel - Cage Motor and Control — The squirrel-cage motor is a fixed speed device. The "off-the-shelf" design will start, stop, and reverse, but must not be so operated too frequently. By relatively simple changes in electrical design, however, it can be made into a good device for frequent starts, stops, and reversals. Any of these motors can be built into two-, three-, or four-speed designs.

Voltage-Control Drive — This is relatively a newcomer in the machine tool field. It has a long history in other industries, and first appeared about 1926 in the machine tool industry as a planer drive. At first, because of its cost and complications, the variable-voltage drive was suitable only for large machines. It consisted of a motor-generator set, exciter, controller, and machine-drive motor.

The basic variable-voltage rotating drive of today is the same as its forebears, except that the motor-generator, exciter, controller, and machine-drive motor have all been improved, and have been so reduced in cost that they can be used on even the very small machines. The tool-room lathe, shown in Fig. 2, is probably the first machine tool equipped with voltage-control electric drive to be built in large quantities. The electric drive has, in this instance, been expanded by electronic control.

A comparatively new development—electronic rectification—can be used instead of the motor-generator set and exciter. There is still some question as to first cost, but up to about 1 horsepower, the electronic conversion costs the same as or less than the rotating type. Above that, up to 200 H.P., it costs materially more at present. In the larger units, its gains in operating economy appear to offset the increased first cost. Maintenance is not yet in favor of electronic rectification.

Electronics as a control device opens a whole new field, particularly for the control of higher power requirements. Manually or automatically

Fig. 2. Monarch Tool-room Lathe Equipped with Voltage-control Electric Drive and Electronic Control

controlled rates of change of speed are all possible with the electronic equipment. Widely controlled speeds for machine tool feeds are also expected to advance with the adoption of electronic rectification and control.

Slip-Ring Motors, Variable- and High-Frequency Alternating-Current Equipment, Selsyns, Synchrotie, and Synchrolock Regulators—These devices cover a vast field, and will more and more find a place in machine tool design. However, except for the application of high frequency to portable tools, they are still far from ready to enter every-day machine tool designs.

There are dozens of other machine tools and machine tool functions which today make use of electric or electronic sources of power. Included in the list are larger lathes, boring machines, millers, planers, shapers, grinders, some machines with specialized and some with standard motor drives, others with variable-voltage or electronically controlled drives. New techniques and additional knowledge acquired out of the war experience are beginning to take tangible shape in developments which promise substantial gains in machining performance. The Machine Tool Show in Chicago will offer the first opportunity for management, production, engineering, and financial executives to measure the full extent of these advances.

Modern Methods of Cutting

Fig. 1. Tandem Shaving of the Seventeen-tooth Gear of a Countershaft Cluster and the Twenty-two-tooth Gear of a Reverse Idler on a Rack Type Machine

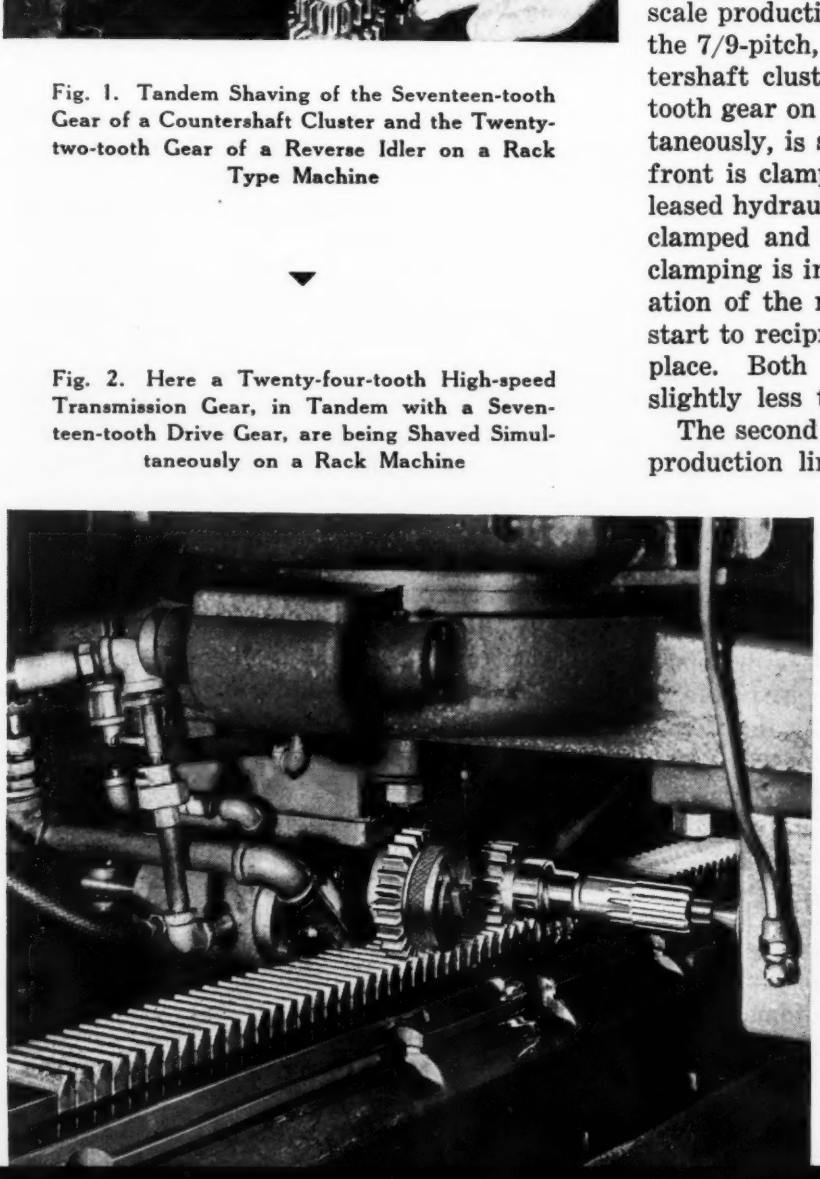


Fig. 2. Here a Twenty-four-tooth High-speed Transmission Gear, in Tandem with a Seventeen-tooth Drive Gear, are being Shaved Simultaneously on a Rack Machine

Truck Transmission Gears are Cut by Three Different Methods and Finished on Two Types of Shaving Machines at the Detroit Gear

GEARS for a 1 1/2-ton truck transmission being produced at the Detroit Gear Division of the Borg-Warner Corporation are cut by three different methods and finished on two types of shaving machines. Of the thirteen gears and splines in this transmission, seven gears are finished on five rack type shaving machines without requiring change-over in tooling.

Simultaneous shaving of two different gears by placing the gears in tandem on one rack type machine is a feature of the gear production line. This is believed to be the first time that this manufacturing method has been used in large-scale production. One of these set-ups, in which the 7/9-pitch, seventeen-tooth gear on the countershaft cluster and the 7/9-pitch, twenty-two-tooth gear on the reverse idler are shaved simultaneously, is shown in Fig. 1. The gear seen in front is clamped by means of a spring and released hydraulically, while the other gear is both clamped and released hydraulically. Hydraulic clamping is interlocked with the hydraulic operation of the machine, so that the rack will not start to reciprocate until the gear is clamped in place. Both of these gears are finished in slightly less than a minute, floor-to-floor time.

The second Michigan rack-shaver used in this production line for finishing two gears at the same time is shown in Fig. 2. Both of these gears are of 7 pitch, one having seventeen and the other twenty-four teeth. These two gears are finished in slightly more than a minute, floor-to-floor time. Mandrels or arbors are not required to load these gears in the shaving machines. These two machines finish more than 200 gears per hour.

Both of the seventeen-tooth gears—one on the countershaft cluster and the other on the drive gear—are cut on alternate spindles of the Cleve-

Truck Transmission Gears

Division of the Borg-Warner Corporation. Simultaneous Shaving of Two Different Gears Increases Production

land hobbing machine seen in Fig. 3. A 3-inch diameter hob is used to cut the countershaft cluster gear, while a 4-inch diameter hob is employed for the drive gear to minimize the formation of scallops and to produce smoother fillets. Double-thread "pre-shave" hobs made by the Michigan Tool Co. are employed in these operations.

The twenty-seven-tooth, 7-pitch gear on the countershaft cluster and the thirty-six-tooth, 7-pitch gear on the low- and second-speed sliding gear of the transmission are cut on Michigan "Shear-Speed" machines in forty-eight seconds per gear cycle time. These machines are equipped with a series of single-point, ground-form tools which cut all the teeth of the gear simultaneously, an in-feed being used for the tools while the work is given a reciprocating motion. About 350 gears are produced per sharpening of the cutters. The tools can be re-sharpened from sixty to seventy times before being worn out, since only about 0.012 inch is removed from each blade per sharpening.

In the "Shear-Speed" machine set-up for the twenty-seven-tooth gear seen in Fig. 5, the work is automatically located and clamped. The illustration shows the work in place before the cut has started. A cut gear unit is seen on the control box of the machine in the foreground. The second "Shear-Speed" machine is also designed for simple automatic clamping, it only being necessary to slip a U-shaped wedge between the gear and the knob on the machine spindle to clamp the gear.

The twenty-four-tooth, 7-pitch high- and third-speed gear of the transmission and the twenty-two-tooth, 7/9-pitch gear of the reverse idler are produced two at a time on alternate spindles of the eight-spindle Cleveland hobbing machine seen in Fig. 6.

Fig. 3. Two Seventeen-tooth Gears—One on the Countershaft Cluster and the Other on the Drive Gear—are Cut on Alternate Spindles of This Hobbing Machine

Fig. 4. A Battery of Six of These Gear Shapers is Used to Produce the Eighteen-tooth Step Gear on the Reverse Idler of the Truck Transmission

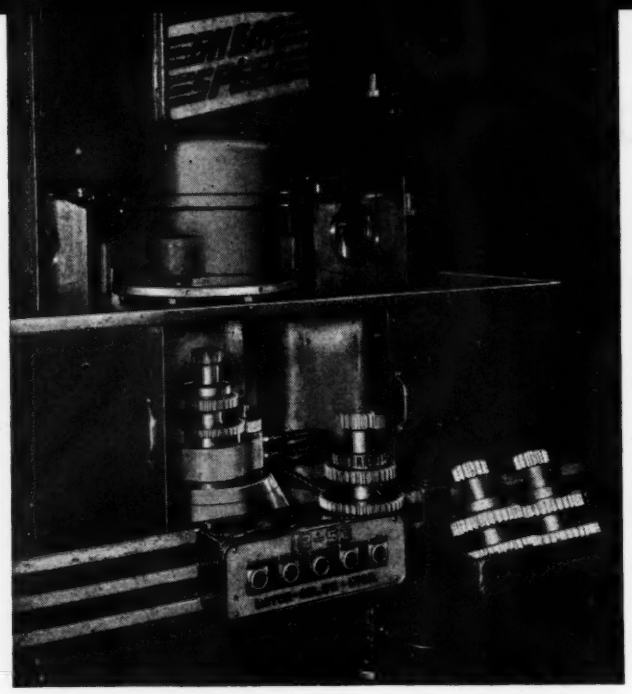


Fig. 5. The Twenty-seven Teeth on a Step Gear are Cut Simultaneously on This "Shear-Speed" Machine in Forty-eight Seconds

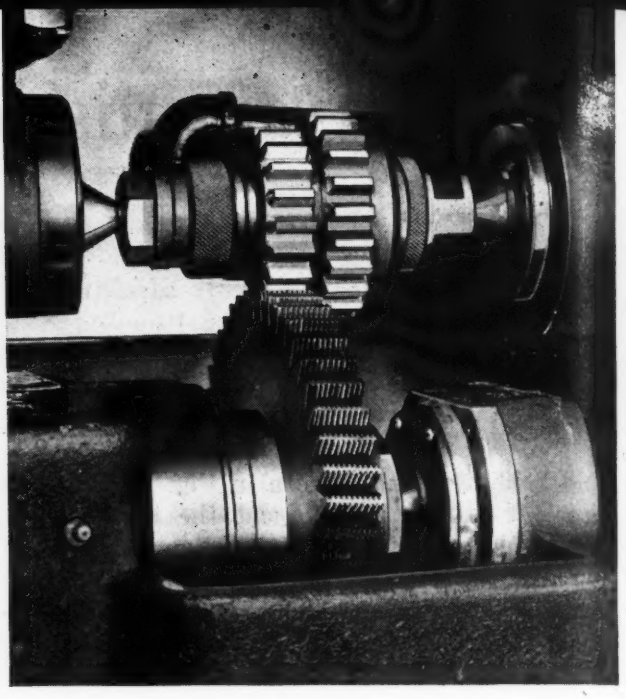


Fig. 7. Close-up View of an Under-pass Type Shaving Operation being Performed on the Eighteen-tooth Step Gear of the Reverse Idler

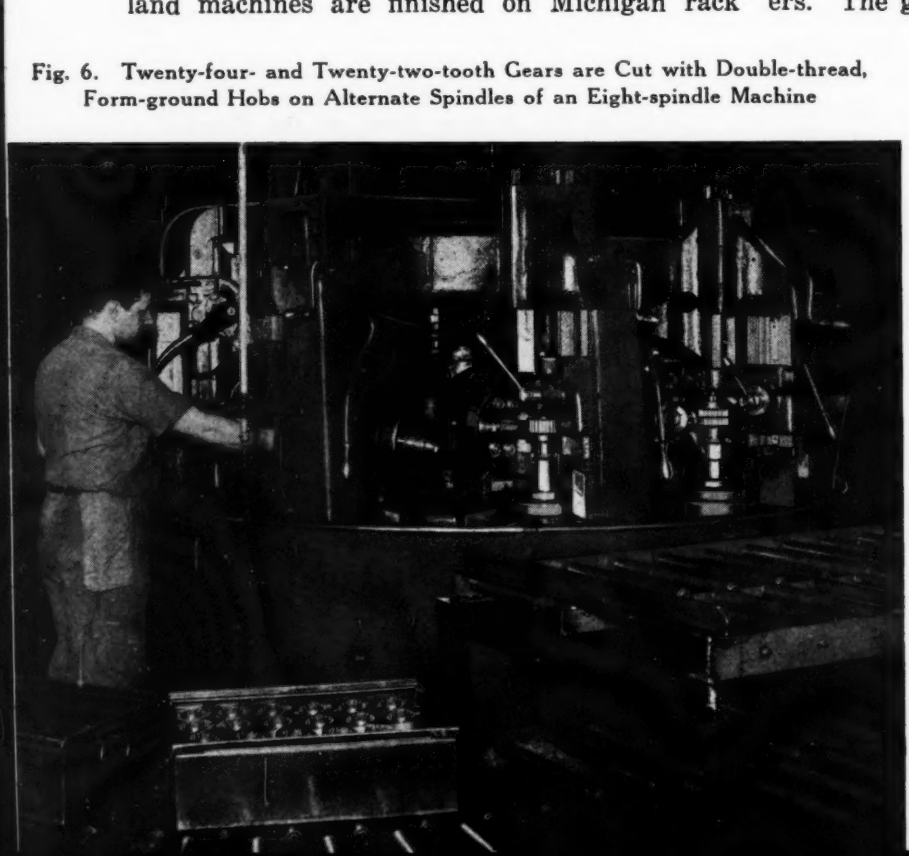
The gears are mounted back to back on the spindles.

The eighteen-tooth, 7/9-pitch gears of the reverse idler are produced on a battery of Fellows high-speed gear shapers, a few of which are shown in Fig. 4. These shapers are equipped with Michigan form-ground "pre-shave" cutters.

Both six and ten splines are cut on the shafts with single-thread hobs. The splines for this transmission do not require shaving. All of the gears cut with double-thread hobs on the Cleveland machines are finished on Michigan rack type shaving machines, as previously described. Gears cut on the "Shear-Speed" machines and the Fellows gear shapers are finished on Michigan under-pass type rotary shaving machines.

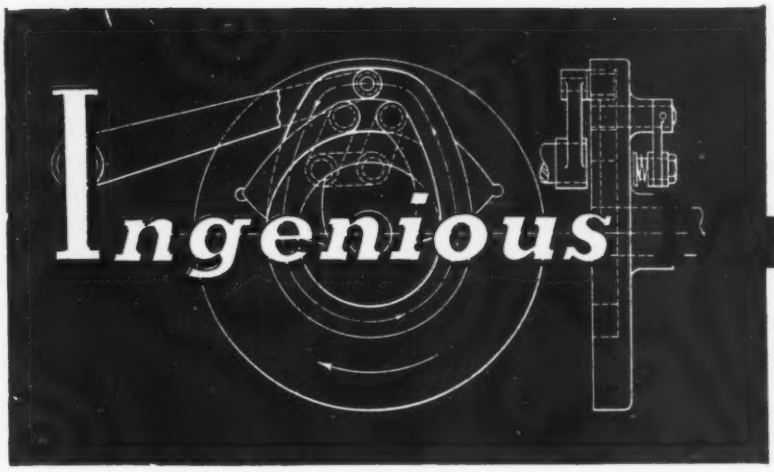
The finishing time (floor to floor) is somewhat less on the under-pass machine than on the rack machines. This is partly due to the fact that the gears finished on the rack machines are cut with double-thread hobs and thus normally require more finishing than the gears produced on the "Shear-Speed" machines and gear shapers. The greater finishing time required, however, is more than made up by the saving in time resulting from the use of "pre-shave" hobs.

Fig. 6. Twenty-four- and Twenty-two-tooth Gears are Cut with Double-thread, Form-ground Hobs on Alternate Spindles of an Eight-spindle Machine



A close-up view of one of the under-pass type shaving machines is seen in Fig. 7. The close shoulder on this countershaft cluster does not interfere with the action of the rotary cutters. This type of machine finishes a gear in an average of less than half a minute. The gears are mounted between centers, no arbor being used. All shaved gears in this transmission are held within 0.002 inch run-out.

Each operator can easily run two finishing machines, since the cycles are completely automatic. The roller conveyors and baskets used to handle the gears prevent the teeth from being marred.



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Follower Mechanism for Contour Milling of Grooves

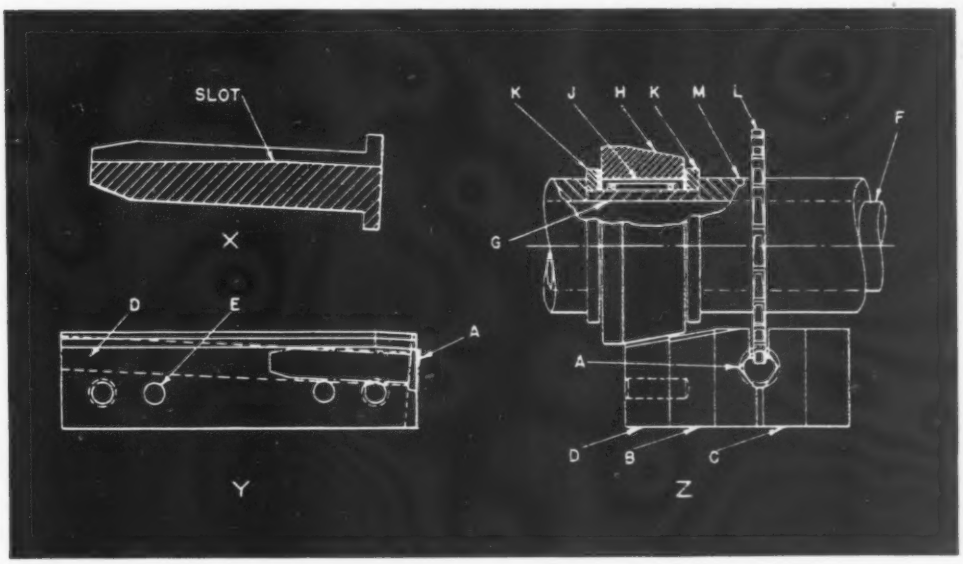
By CHARLES E. LAMBERT, Process Engineer
Underwood Corporation, Hartford, Conn.

The usual method of machining a straight slot, the bottom of which changes from a parallel to a tapered surface at some point along its length is to make two passes with a milling cutter, one for each of the intersecting planes. With the proper type of contour follower, however, both surfaces can be machined in one pass, and production correspondingly increased.

The device shown at *Y* and *Z* in the accompanying illustration was designed to form such a slot in a cylindrical part, as shown at *X*. The work *A* is located in V-blocks and clamped between a fixed jaw *B* and an adjustable jaw *C* which are fitted to a 4-inch quick-acting vise. Templet *D*, which has the contour to be produced on the work machined on its surface, is fastened to the fixed jaw by dowel-pins *E*.

The follower roller *H* is attached to the milling machine arbor *F* in such a position that it rolls on the templet when the milling machine table is raised to maintain contact between the roller and templet during the feeding movement. Bushing *G* is made a slip fit over the arbor, and roller *H* is pressed on a needle bearing *J*, which revolves freely between two collars *K*. Both the templet and the roller are machined at an angle, so that the distance of the roller from the milling cutter *L* can be adjusted by adding or removing spacers *M*, thus varying the height of the cutter above the work and hence the depth of the slot.

In operation, the vise is mounted on the table of a hand milling machine. Attached to the end of the handle controlling the vertical movement of the cutter is a weight which maintains pressure on roller *H*, so that it is kept in contact with the templet. When the longitudinal feed of the machine is engaged, the roller follows the contour of the templet, causing the cutter to mill the slot to the same contour.



Follower Mechanism Used in Milling a Contoured Slot in a Cylindrical Part as Shown at X

Mechanism for Operating Dial Feed and Radially Positioned Multiple Punches

By CHARLES F. SMITH

The mechanism shown in the accompanying illustrations was developed for operating an indexing type dial feed and radially positioned multiple punches used for the production indenting of thin-walled tubes, such as indicated at *B* in the enlarged view at *A*, Fig. 1. The tube *B* serves as a means of assembling or joining the wooden rod *C* to the cylindrical rubber piece *D*.

The function of the dial feed mechanism is to pick up the assembled rod *C*, tube *B*, and rubber *D* at *E*, Fig. 2, and by successive intermittent indexing movements in the direction indicated by the arrow, bring these assembled members into the position indicated by the dot-dash lines at *F*. While the work dwells in this position, the eight radially located cam-operated indenting punches *G* are advanced to produce sixteen indentations, which serve to securely fasten tube *B* to rod *C* and rubber *D*.

After the indenting operation, the work is indexed around toward the rear of the dial feed, where it is unloaded on a conveyor or picked up by another feeding dial. Thus one assembly is indented at each dwell period between successive indexing movements of the dial.

Referring to Figs. 1 and 2, it will be seen that the feeding dial consists primarily of two disks *H*, each fitted with twelve radially positioned, equally spaced slides *J* having U-shaped slots at their ends which pick up and carry the work. Each slide *J* has a cam roller *K* which runs in a cam groove in the face of one of the two stationary cam-plates *L*.

The cam grooves in plates *L* are so laid out, as shown diagrammatically in Fig. 3, that roller *K*, instead of following the concentric path indicated by circle *M*, follows the path indicated

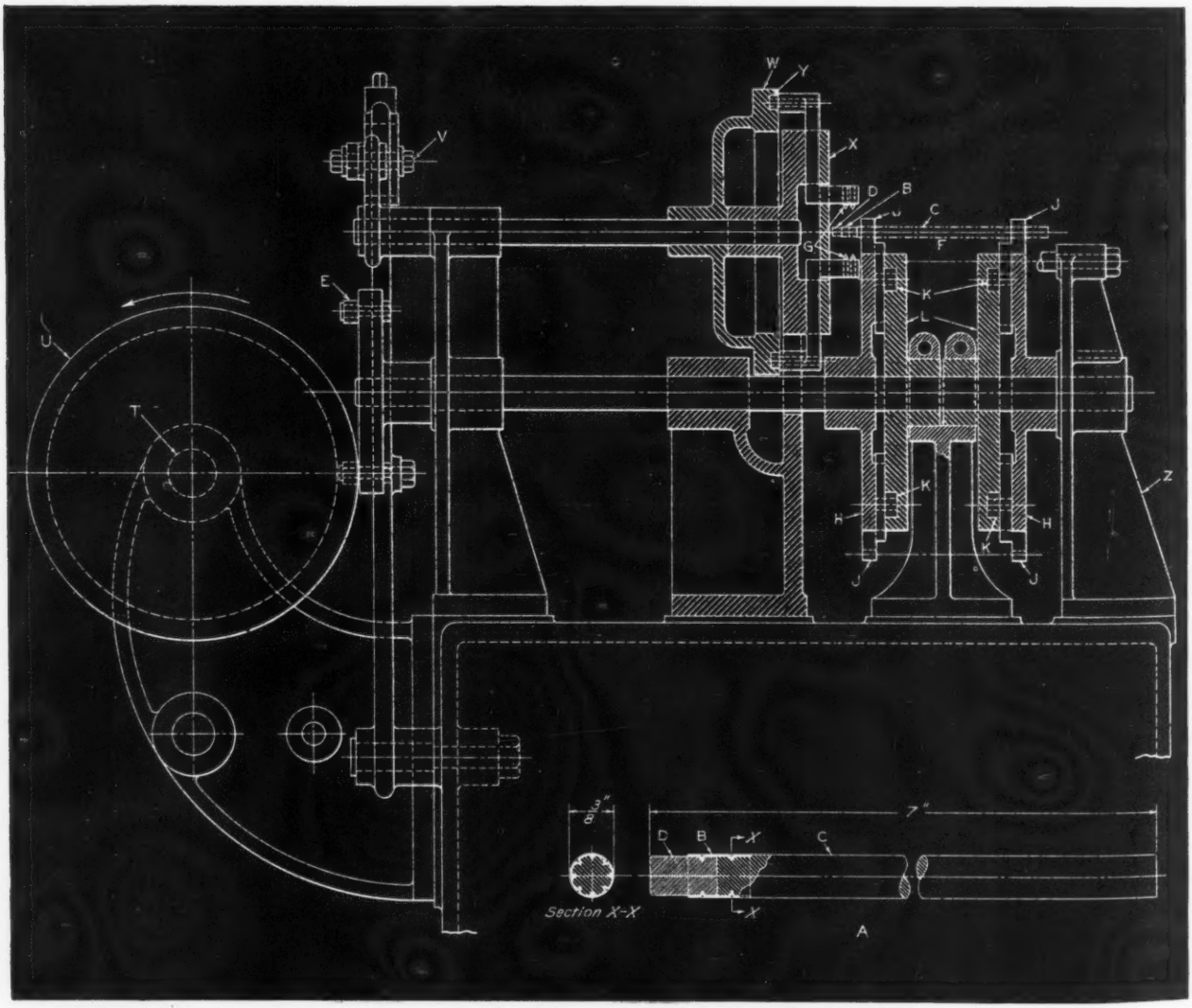


Fig. 1. Mechanism Developed for Synchronized Operation of Dial Feed and Punches for Indenting Tubes B on Assemblies Such as Shown at A

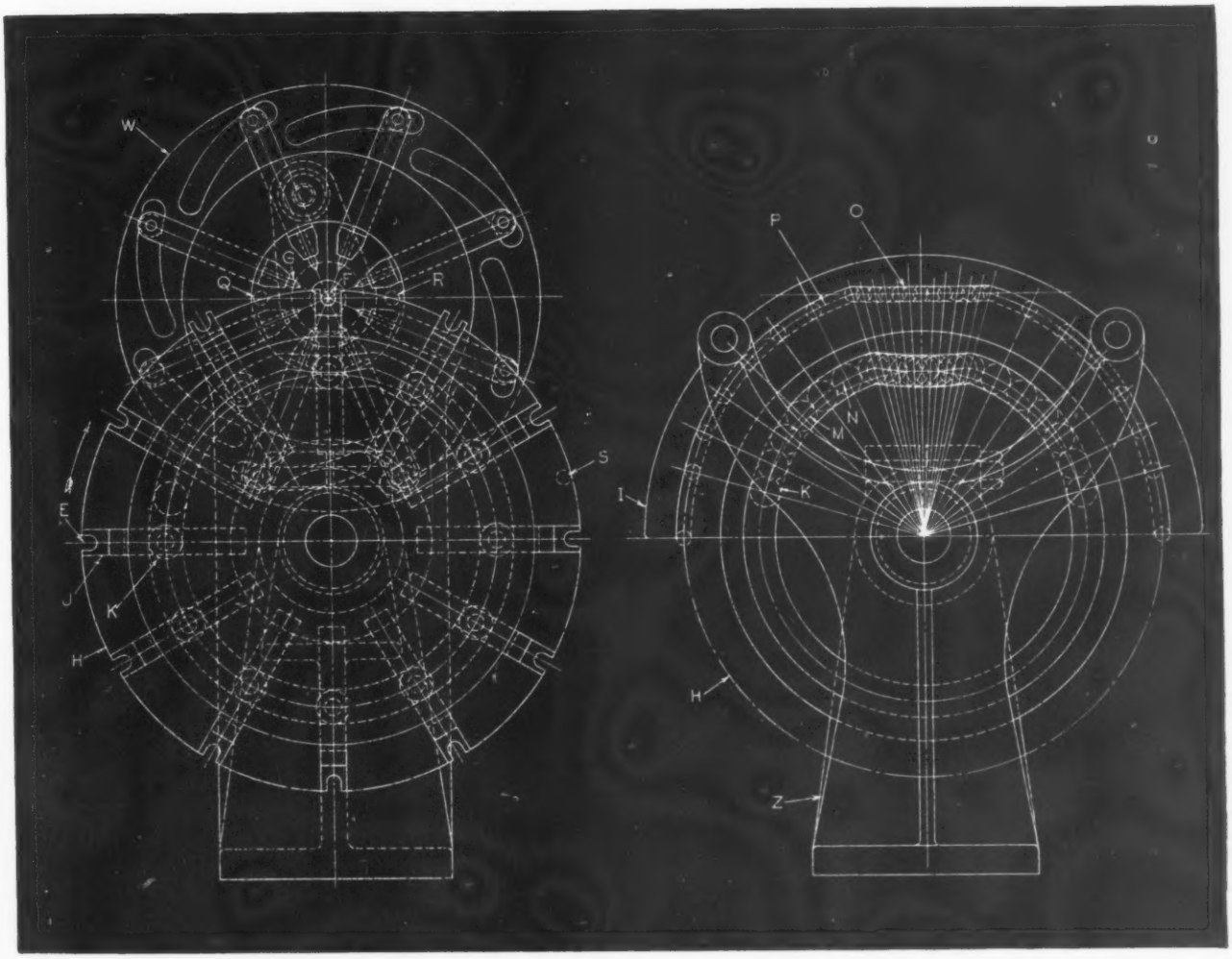


Fig. 2. (Left) End View of Indenting Punch and Dial Feed Shown in Fig. 1
Fig. 3. (Right) Diagrammatic Lay-out of Cam L and Bracket Z, Fig. 1

by line *N* as the disk *H* is indexed from one position to another. This causes the slides *J* to carry the work along the path indicated by line *P* and the circles *O*.

It will be noted that the work follows a path that leads away from the center of the dial or disk *H* as it leaves the loading position *E*, Fig. 2, until it reaches the position *Q*, after which it follows a straight horizontal path from *Q* to *R*, from which position it continues on a path that carries it back toward the center of the dial until it reaches the position indicated at *S*. It is necessary to have the work follow this irregular path in order to permit the tube *B* and rubber *D*, Fig. 1, to clear the indenting punches and holders as they are being indexed from *Q* into the indenting position at *F* and out again to the position *R* after being indented.

The intermittent indexing movements are transmitted to the feeding dial disks *H* from the driving shaft *T*, Fig. 1, through the cam *U* and dial driver *E*. The eight indenting punches are simultaneously moved inward radially to perform the identing operation by means of the oscillating cam *W* operated from shaft *T*. The depth of the identations can be controlled by adjusting the length of throw of the cam oscillating mechanism. The oscillating movements of cam *W* are, of course, synchronized with the indexing movements of the work-carrying dial so that the indenting punches advance and withdraw while the work-feeding dial is stationary in one of its twelve dwell positions.

The holders of the indenting punches *G* are close sliding fits in the slots in the stationary head *X*, and have rollers *Y* which are running fits in their respective operating cam slots. The bracket *Z*, Fig. 3, supports a cover *I*, which keeps the work in place in the slots in slides *J* while it is being indexed from the loading position at *E*, Fig. 2, to the unloading position. The cams *L*, Fig. 1, are made with hubs mounted in a center pedestal equipped with a split bearing having clamping screws which provide means for individually adjusting the positions of the cams to obtain accurate alignment of dials *H*.

Engineering News

Inert Gas Cooled Motors Insure Safety in Inflammable Atmospheres

To insure against explosion in a highly inflammable atmosphere, the General Electric Co. is building two special 300-H.P., 240-R.P.M. synchronous motors that are filled with an inert cooling gas. This non-combustible gas is cooled by contact with built-in water coolers and is then circulated through the motor to carry heat away from the windings; the pressure is sufficient to insure that any leakage will be outward, and no air or inflammable gas will get into the motor. The inert gas follows unrestricted flow lines in the cooler, which is located over the motor, to give efficient heat transfer. The cooler can be removed for inspection or maintenance.

Resistance temperature detectors are embedded in the stator windings. They are used with a temperature relay to remove the motor from the line in the event that the maintenance man forgets to turn on the cooling water or the temperature of the stator windings becomes excessive for any other reason.

Ultra-Sensitive Pyrometer for Gas Turbines and Jet Engines

An improved pyrometer for measuring the temperatures of the high-temperature high-velocity exhaust gases of gas turbines and jet engines has been developed by Andrew I. Dahl of the National Bureau of Standards in cooperation with the Bureau of Ships, Navy Department. This instrument will serve not only for evaluating engine efficiency, but also for protecting experimental and service equipment from damage by excessive temperatures.

The new pyrometer consists essentially of an ordinary thermo-couple junction around which is pressed a small, light silver shield. The main problem in measuring the temperature of the hot gases is preventing the transfer of heat to or from the thermo-couple junction by radiation. The shields formerly used for this purpose were not only bulky and slow to respond to changes in temperature, but also offered considerable obstruction to the stream of gas. The use of a silver shield overcomes these limitations, since silver, being a good reflector and a poor emitter of radiant heat energy, keeps the temperature of the shielded junction nearly the same as that of the gas.

This device was found accurate to within 5 degrees F. in experiments utilizing a stream of gas at 1500 degrees F. flowing with a velocity at 250 feet per second through a pipe with walls at 1200 degrees F. In addition to high accuracy, laboratory tests indicate that this pyrometer responds quickly to changes in temperature, is simple to construct and easy to install, and that the new junction creates a minimum of disturbance of gas flow.

Westinghouse Produces Wire Strand Only 0.00018 Inch in Diameter

The Westinghouse Lamp Division recently produced a strand of tungsten wire so microscopic that 1000 feet of it reeled on a bobbin is invisible to the unaided eye. The wire, which is 0.00018 inch in diameter, is the smallest produced in the forty-year history of wire-drawing in the Lamp Division's tungsten department. It was calculated that a twenty-layer stack of the wire would equal the thickness of a sheet of newsprint, and that a pound of it would stretch in a single strand for 950 miles.

Engineers computed the average diameter by weighing an 8-inch long strand of the wire on a scale balance sensitive enough to record the weight of a pencil mark on a stamp.

Grinding Parabolic Optical Mirrors for Use in a Wind Tunnel

Pyrex glass disks, 30 inches in diameter by 6 inches thick, for use in the optical system of a new high-velocity wind tunnel at Langley Field, were surface ground to within 3 light bands for flatness. Two of these fine optical pieces are to be used as parabolic mirrors for testing air turbulence in the wind tunnel.

One side of each disk was ground flat and the other side concave on a standard Blanchard vertical-spindle surface grinding machine. By grinding 48 1/2 pounds of glass from one casting and 60 pounds from the other, which was done in less than twenty-six hours, about 160 hours time was saved over conventional laboratory grinding methods.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Modified Lathe Set-Up for Continuous Threading of Bar Stock

By MARK W. PURSER, Tenafly, N. J.

Continuous threads can be cut on long pieces of bar stock by means of the modified lathe set-up here illustrated. This arrangement was devised by the Farmingdale Aircraftsmen Mfg. Corporation, Farmingdale, N. Y. As shown in Fig. 1, the die-head is rotated in the chuck of a small engine lathe, and the bar stock to be threaded is fed through it.

One operator can attend three or four machines arranged in this manner. Class 3 threads having a lead error of not more than 0.001 inch per inch can easily be produced on tough alloy steel by means of this set-up.

The right-hand end of the bar stock is guided by a piece of pipe that has a longitudinal slot in both front and back. A cylindrical locking piece, with two bosses that slide in the slots of the pipe, is fastened to the unthreaded end of the bar with set-screws, thus preventing the bar from revolving as it is drawn to the left by the rotating die-head. The upper and lower sections of the slotted pipe are held together by welded straps that permit the bosses of the locking piece to pass without interference.

After several feet of threaded bar have issued from the left-hand end of the hollow lathe spindle, a special pair of pliers with threaded jaws is fastened on the bar. The locking piece can then be removed from the unthreaded end before it reaches the die-head. Guide rods, shown attached to the wooden trough in back of the headstock, permit these pliers, which are of the self-locking toggle type, to move horizontally with the threaded bar, but prevent the pliers, and consequently the bar, from rotating.

Coolant is supplied to the die-head by means of the attachment shown in Fig. 2. The coolant flows from supply pipe *P* through the neoprene gland *G* and rotating hollow lathe spindle *S* to the die-head mounted in the chuck at the right-hand end of the spindle. The coolant is prevented from escaping at the left-hand end of the attachment, before the threaded bar reaches that position, by the weighted gravity flap valve *V*. The valve fits tightly on the angular end of the attachment and seals it.

When the threaded bar reaches this flap valve, it simply lifts it to the position shown. Escape of the coolant is then prevented by the neoprene

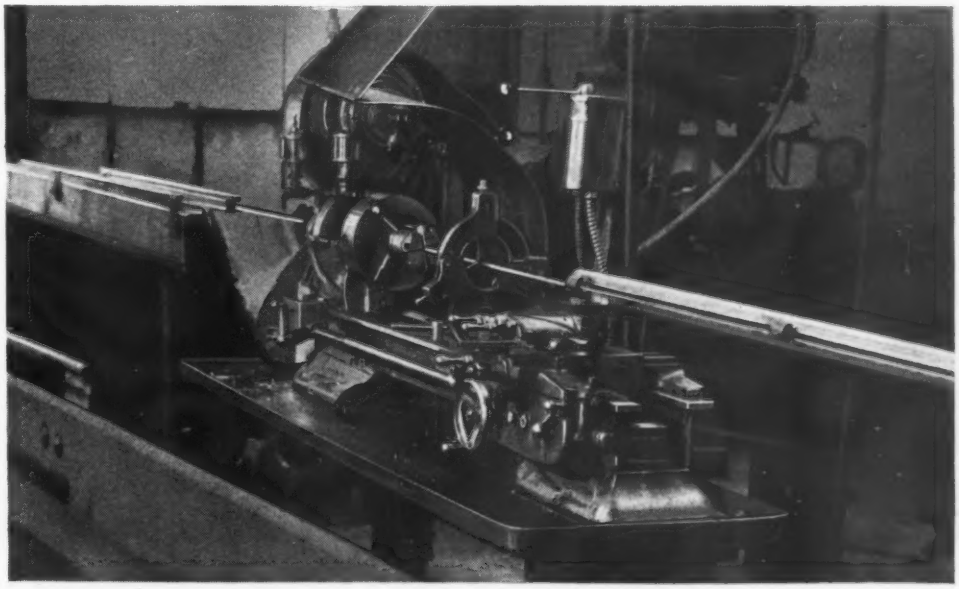


Fig. 1. Long Bars can be Continuously Threaded by Means of the Set-up Shown. The Die-head is Rotated in the Chuck of the Lathe and Draws the Threaded Bar through the Hollow Spindle

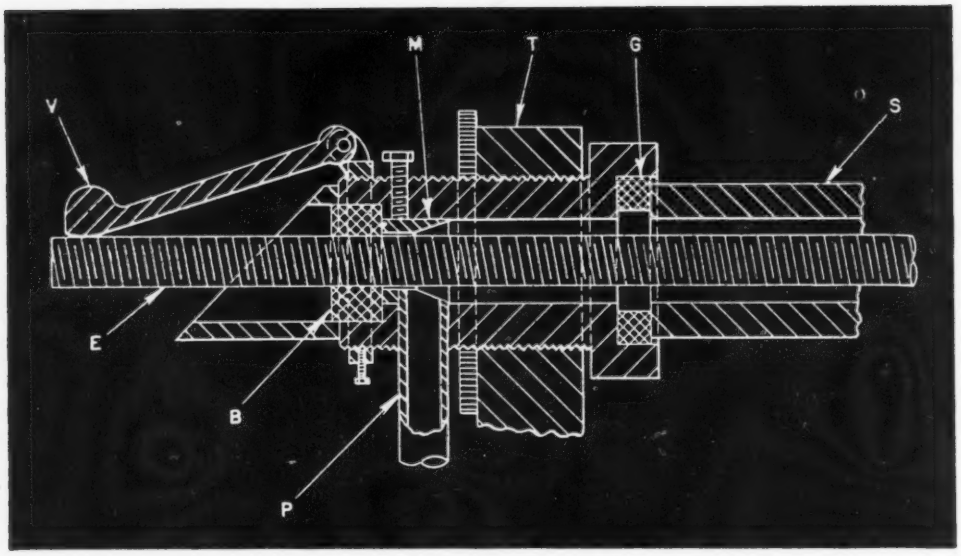


Fig. 2. Attachment that Provides Coolant for the Die-head Shown in the Set-up in Fig. 1. A Flap Valve Prevents the Coolant from Escaping at Left-hand End of the Attachment

bushing *B* through which the bar threads itself. The threaded bar forms internal threads in this pliable neoprene bushing, thus providing an effective seal and preventing the coolant from escaping. The bar is guided into the neoprene bushing by the tapered hole in ring *M*. Both the guiding ring and bushing can be changed to suit different sizes of bar stock. The entire attachment is held rigidly against the left-hand end of the rotating spindle by support *T*.

Multiple Belt Drive with Thrust Equalizing Arrangement

By MARTIN H. BALL, Watervliet, N. Y.

The unusual belt drive shown in the accompanying illustration was designed to drive the six spindles *A* to *F*, inclusive, at the same speed, from a single electric motor *O*, with the side thrust on each spindle not exceeding that which would be exerted by a single belt on the spindle. This was accomplished by balancing the force transmitted from each spindle so that it would equal the force transmitted to each spindle less the force absorbed by the spindle. The motor

Unusual Belt Drive, by Means of which the Six Spindles A to F are Driven at the Same Speed

carries an 8-inch pulley *G* which rotates a 5-inch pulley *H* on spindle *A* by a size P belt. This arrangement drives spindle *A* at the required speed, but exerts a thrust on the spindle equal to the power required to drive all six spindles. This unbalanced thrust is offset by transmitting in the opposite direction the power required to drive five spindles, using 4 1/2-inch pulleys *J* and a size R belt.

The next spindle *B* receives the power in one direction required to drive five spindles, but transmits the power for driving four spindles in the opposite direction, and so on to the end of the transmission. Pulleys *K* are 4 inches in diameter; *L* 3 1/2 inches; *M*, 3 inches; and *N*, 2 1/2 inches. This decrease in size of pulleys to correspond with the reduction in power to be transmitted and slower belt speed serves the purpose of balancing the side thrust exerted on the spindles. The equality of speeds of all spindles is not affected, since the driving and driven pulleys of adjoining spindles are of the same size.

Milling Threads on Valve Stems

By E. N. OLSON, Leadingman Machinist
Terminal Island Naval Shipyard
Terminal Island, San Pedro, Calif.

Acme threads of six, eight, or ten threads per inch can be milled on valve stems much quicker than they can be chased on an engine lathe with a single-point tool. While this method does not produce precision threads, it is good enough for a valve stem that must work freely, such as one that is about a Class 1 fit.

Moreover, there is no need to procure special thread milling cutters; the ordinary No. 1 spur-gear cutter of suitable diametral pitch will do the job. For example, a No. 1 spur gear cutter of 20 diametral pitch is used to cut an Acme thread of six threads per inch; valve stems with eight or ten threads per inch can be milled with cutters having a diametral pitch of 28 and 30, respectively.

The thread should be cut so that it works freely in the nut. Upon examination of the completed job, it will be noted that the thread is somewhat deeper than standard and is slightly curved on the sides. However, these discrepancies are negligible in free-acting assemblies.

There is an appreciable saving in manufacturing time when threads are milled in this manner on a thread miller, using the back rest as support. Another result is that the method eliminates the constant regrinding and breakage of tools that is common when threads are cut on an engine lathe, especially when they are cut in stainless-steel stock.

* * *

Approximately one in every seven workers in the United States—or a total of 8,200,000 persons—are employed by businesses built on the production, sales, service, or use of motor vehicles, according to the Automobile Manufacturers Association. There are over 500,000 concerns engaged in various branches of the automotive industry.

by a Single Motor, and at the Same Time, the Side Thrusts Exerted on the Spindles are Balanced

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

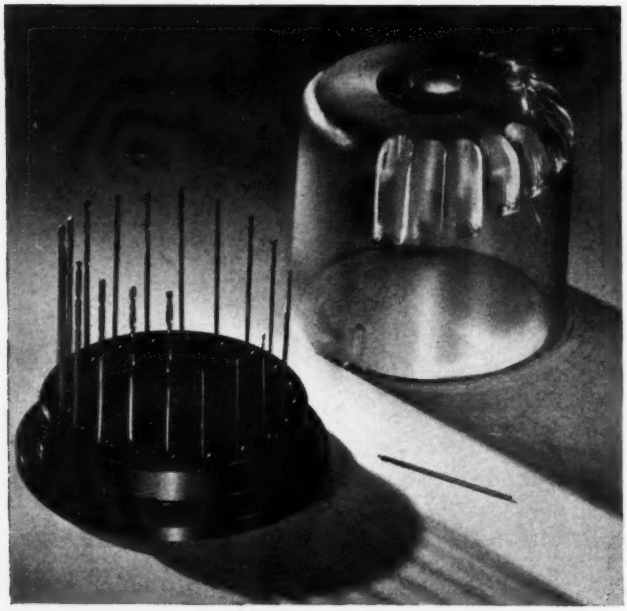
Low-Melting Flux for Brazing Sheet Aluminum

All-State Welding Alloys Co., Inc., 96 W. Post Road, White Plains, N. Y., has announced the availability of an aluminum flux for brazing sheet aluminum. This flux has a low melting point—around 950 degrees F.—and becomes quite active at 1000 degrees F. It breaks down into a completely liquid state, and gives excellent capillary action to the aluminum brazing alloy. The flux is readily removed by immersing the joint in hot water while still hot. 201

Process that Provides Long-Term Protection for Ferrous Metals

An anti-corrosive process known as "Zincilate," which is claimed to provide twenty years of protection to ferrous metals against all common types of corrosive action, is being introduced on the market by Industrial Metal Protectives Corporation, of Newport News, Va. Only one coat is needed for protection. The coating possesses high abrasion resistance. Even when sizable areas are destroyed by unusual scraping or wear, lasting protection is said to be assured through cathodic sacrifice of the film. Zincilate is unaffected by 1000 hours of exposure in standard salt fog corrosion equipment, as approved by the American Society for Testing Materials. This compares with maximum specifications for the Army and Navy of only 200 hours of salt spray exposure.

It has been used successfully on pipe lines, on the interiors and exteriors of water and gasoline tanks, on bridges, machine parts, and marine installations, where it affords not only anti-corrosive but also anti-fouling protection. 202



Holes Ranging in Size from 0.014 to 0.040 Inch were Accurately Molded in This Drill Stand of Bakelite Plastic. A Transparent Plastic Cover Holds the Drills Securely in Place when Not in Use

New Compounding Process for Thermoplastic Materials

After four years of development, including two years of successful use in quantity production, Hungerford Plastics Corporation, Murray Hill, N. J., is making available a basically new process for the compounding of thermoplastic materials.

This process, which is applicable to practically all materials requiring the addition of a liquid plasticizer, eliminates the use of solvents and slurries, as well as the usual steps of combining the materials into a fused mass, mechanical working, hardening, and grinding.

With the new process, the flake or resin, dye, pigment, stabilizer, extender, and filler are charged into a compounding chamber which is rotatably mounted. During rotation, the plasticizer and other liquid additives are spray-injected into the chamber, after which the material is dehydrated by filtering hot dry air through it as the chamber continues to rotate. The material, which remains in powder form throughout the process, is then ready for feeding into standard molding and extruding equipment. The process is available on a licensing and royalty basis. 203

"Wash Primer" for Preparing Metal Surfaces for Painting

A product known as "Wash Primer," developed during the war by the Bakelite Corporation, 300 Madison Ave., New York 17, N. Y., and now available for commercial use, overcomes many difficulties experienced with coatings used for metal-surface conditioning, such as freezing at low temperatures, lack of uniform deposit, and poor water resistance. This compound serves as a metal-surface conditioning agent to replace the usual inhibitive wash coat and also as a priming coat which gives temporary protection to the metal between the time of preparation and of paint application.

Its hardening action is not dependent on either oxidation or polymerization, so that subsequent coats of paint can be applied as soon as the solvent has partially evaporated—usually in ten to twenty minutes—depending upon temperature and ventilation. After being air dried or baked at a low temperature, it provides excellent adhesion with a fair degree of flexibility when applied to steel, aluminum (anodized and unanodized), tin, galvanized iron, stainless steel, and similar metals. 204

Lucite "Dry-Air" Pump Barrel Improves Silica Gel Check

A transparent plastic—"du Pont Lucite"—has been adopted by the Andrew Co., Chicago, Ill., to replace metal in the manufacture of dry-air pumps. These pumps are designed to supply dehydrated air wherever moisture must be excluded to permit the proper operation of equipment. The original metal barrels were constructed with "windows" so that the silica gel through which the air passes for moisture removal could be constantly observed. The windows proved unsatisfactory in that they did not permit observation of the gel at all points. The Lucite barrel permits a constant check on the change in color of any part of the gel, which indicates the amount of moisture absorbed. 205

Liquid Solvent Removes Rust Deposits on Metal Surfaces

A liquid rust remover developed during the war and produced by Allied Products Co., 1133 W. Newport St., Chicago, Ill., is now being marketed under the name "CorOdex." The compound is said to be effective on any metal surface and it penetrates readily to reach pin point spots, pits, crevices, cracks, or corners. Large surfaces or parts are treated with a paint brush or cotton swab, while small rust-coated objects may be dipped directly in the solution or left to soak in it. 206

Phenolic Resin Coating Protects Metal and Wood Products

"Phenoglaze," a phenol-formaldehyde protective coating manufactured in England for use on all types of wood and metal products, is now available to fabricators in this country through the Phenoglaze Sales Corporation, New York City. Tests have established that this plastic film is impervious to heat, moisture, and chemical action such as that of salt, gasoline, oil, alcohol, turpentine, acetone, and other corrosive agents. It is air-drying and cold-setting. The coating can be obtained in colors or colorless. It is applied by spray, brush, or dipping. ...207

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in August, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....POSITION OR TITLE .....
[This service is for those in charge of shop and engineering work in manufacturing plants.]

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BUSINESS ADDRESS .....

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Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

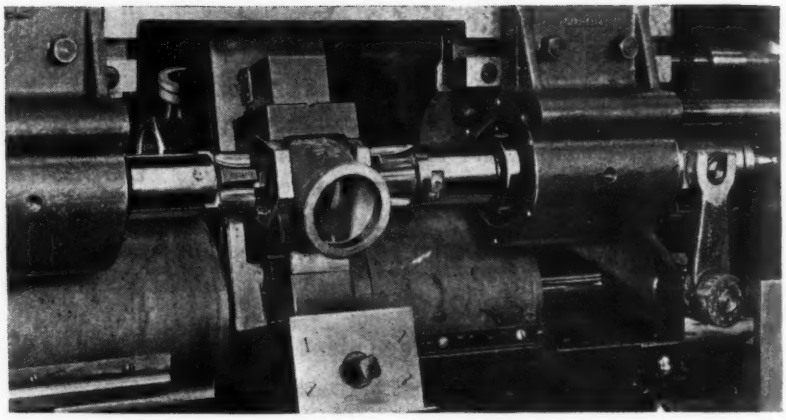


Fig. 2. Close-up View of Third-position Spindles of New Britain Chucking Machine, Equipped for Tapping Threads in Brass Valve

New Britain Double-End Six-Spindle Chucking Machine and Precision Contour Boring and Turning Machine

The New Britain-Gridley Machine Division of the New Britain Machine Co., New Britain, Conn., has announced the development of a new double-end, tool-rotating type chucking machine. This machine (Fig. 1) and a new precision contour boring and turning machine (Fig. 3) will be exhibited at the coming Machine Tool Show in the Dodge-Chicago plant. The double-end chucking machine has six spindles, three on each side of a four-station vertical turret. It is designed to drill, bore, face, ream or thread both sides of a piece in three successive positions, the fourth position being

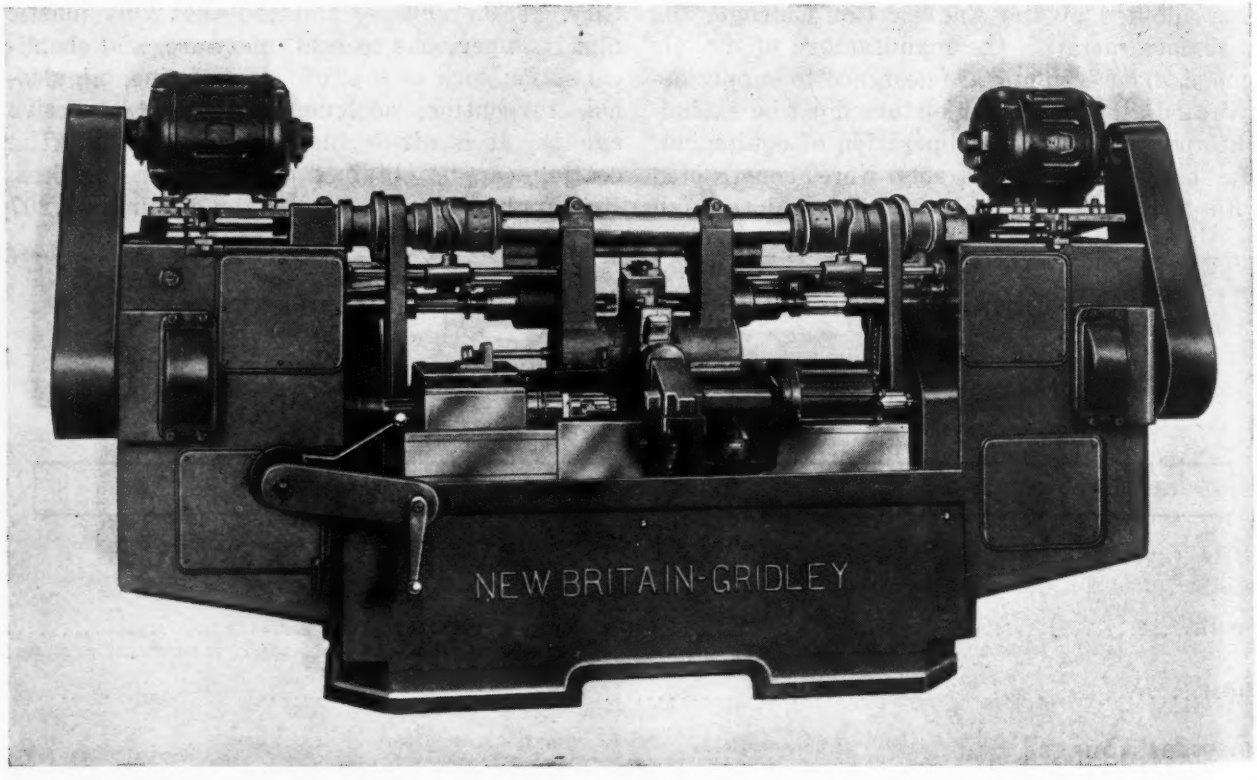


Fig. 1. New Britain Double-end Six-spindle Tool-rotating Type Chucking Machine

To obtain additional information on equipment described on this page, see lower part of page 202.

reserved for loading. In some cases, two pieces can be finished simultaneously.

Automatic and safe operation, using tungsten-carbide tooling, and accessibility of adjustment for all essential parts are features of this machine. Rapid traverse feeds, high spindle speeds, and a total idle time of the indexing cycle of 1.67 seconds make it capable of high production on both steel and non-ferrous metals.

The working stations on the machine form a square, with the first and second stations at the bottom corners and the third and fourth stations at the top corners. The spindles in the first and second positions are fed by a drum cam having rapid traverse and regular feed. These two spindle positions on the same side of the chuck-carrier are mounted in the same longitudinal tool-slide and are brought into position simultaneously. They are operated independently of the first- and second-position spindles on the other side, and are mounted in adjustable quills which can be set for long or short jobs, thus eliminating tool overhang, weaving, and eccentricity.

The threading spindles in the third position are also brought up to the work by rapid traverse, and can be fed in by a lead-screw or lead-cam arrangement. When the tap or die has reversed and backed out, the spindle is returned by rapid traverse to its withdrawn position and the chuck-carrier is indexed. A 2-inch valve body, for example, can be bored, faced, threaded, and removed from the chuck in 9 1/2 seconds. On some jobs, having a total stroke from one side to the other of not more than 4 1/2 inches, the piece can be bored all the way through from either the right- or left-hand side. The spindles on the right- and left-hand sides may "chase" each other on certain operations, and have an overlap of 1 3/4 inches on the center line of the chuck.

The threading spindles in the third position, shown in Fig. 2, are located in a sliding quill, instead of being adjustably locked, like the other spindles, for either lead-cam or lead-screw type threading. This sliding motion is used for "jumping" the tap or die ahead or for reaming. The threading spindles are regularly controlled by "thread jump" and lead cams or reaming cams, located on right- and left-hand drums, which are mounted on an overhead tie-bar and driven by a chain from the main camshaft.

The spindle speeds range from 186 to 2000 R.P.M. The spindle feeds per inch of cam setting range from 0.0046 to 0.046 inch for turning, and from 0.0014 to 0.014 inch for facing. The strokes for the first- and second-position spindles, right- and left-hand, are 4 1/2 inches. The stroke for the third-position, right- and left-hand threading spindles, when using lead cams, is 6 inches for threading, including "jump." The strokes for the third-position, right- and left-hand threading spindles, when using the lead-screw, are 6 inches, including 2 1/2 inches of lead-screw travel. For reaming, the maximum stroke is 6 inches on either the right- or left-hand side, or both.

This machine is designed to handle any kind of casting or forging whose gripping diameter does not exceed 4 1/16 inches and whose length does not exceed 10 inches. It has a capacity for cutting a straight thread, on either or both ends, of 3 5/8 inches in diameter, 6 threads per inch, or for a 2-inch standard pipe tap. The tool swing or the largest diameter of boring and facing tools is 6 1/2 inches. The largest die-head that can be used on this new machine is 7 1/4 inches in diameter.

The machine is 130 inches long, 40 inches wide, 73 inches high, with work-holding fixture or chuck-carrier located equidistant from both ends, and weighs 12,000 pounds. Driving power is supplied at each end and consists of two 10-H.P., 1800-R.P.M. motors.

The new contour boring and turning machine is designed to perform precise second-operation work. In addition to the regular jobs of straight boring and turning, facing, and chamfering, the compound action obtained from contours on the two cams controls the single-point tool in producing lands, steps, recesses, flanges, counterbores, and radii. This tool is fed free to the bottom of the bore and cuts on the drawback stroke.

For jobs too complicated for a single-point tool, a tool cluster arrangement can be employed. Either work or tool can be held in the spindle to adapt it for a wide variety of work. It is claimed that this machine is so accurate that only one dimension of its

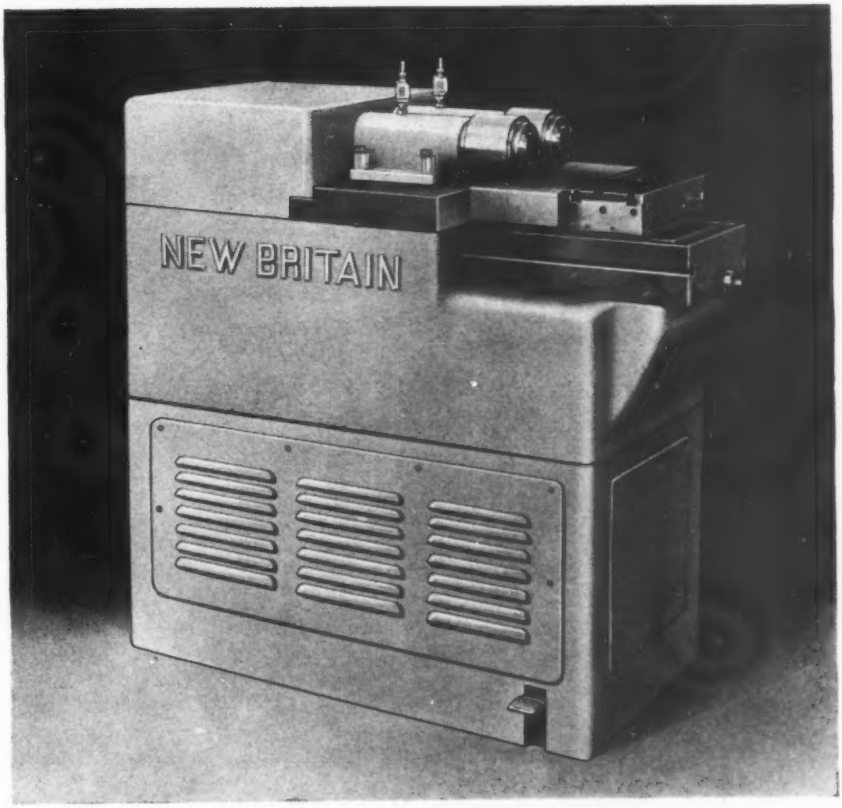


Fig. 3. New Britain Precision Contour Boring and Turning Machine

To obtain additional information on equipment described on this page, see lower part of page 202.

work need be inspected; if the cams are correct, variations on other dimensions cut by the same tool are impossible.

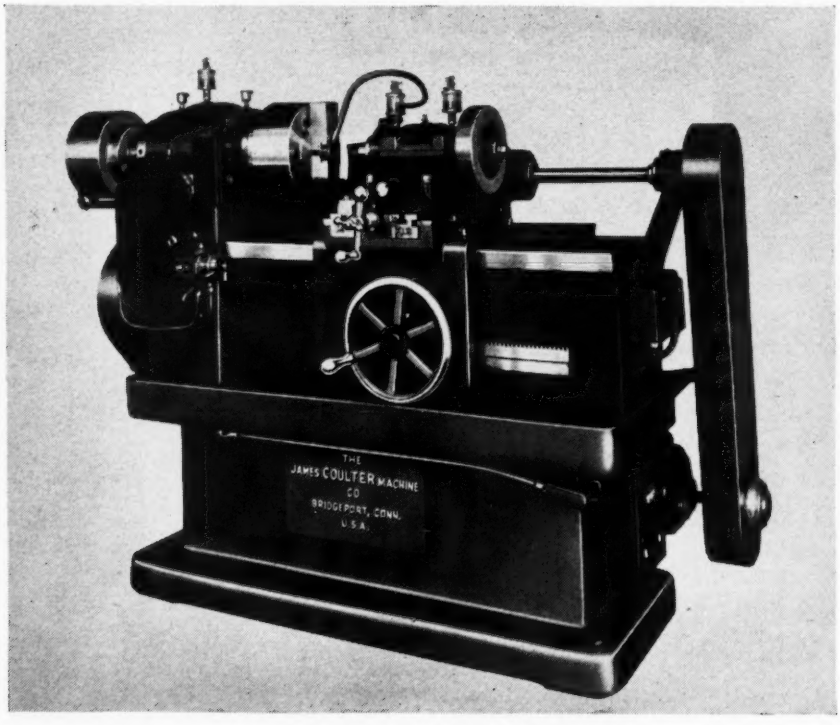
The machine is cam- and air-actuated, and is equipped with safety devices to prevent injury to the operator or damage to the machine. Two different sized models are made, and spindle speeds up to 6000 R.P.M. are available. 61

Coulter Thread Milling Machine for Straight and Tapered Dies

The James Coulter Machine Co., Department R, Bridgeport 5, Conn., has recently adapted its straight and tapered hob thread-milling machine for milling the threads of straight and tapered dies. A large range of speeds and feeds is made available on the new machine by employing separate motors for driving the work- and the cutter-spindles. With this arrangement, the variation in speeds and feeds required for both carbon steel and high-speed steel dies is readily obtainable, stepless changing of the cutter-spindle speeds within the range of 100 to 650 R.P.M. being possible. This permits maintaining the proper speed when using small-diameter milling cutters for milling small dies. With the standard change-gears furnished for the work-spindle drive, machine cycles from 26 to 155 seconds are possible for handling the range of die sizes within the machine's capacity.

With the relieving attachment, dies having any number of cutting edges can be produced in one revolution of the work. Eccentric and non-eccentric reliefs can be produced on each land. All lands are identical in every respect, as one revolution of the relieving cam produces only one land. The adjustment for the number of lands to be thread milled and relieved is controlled by simple pick-off gears in the gear train.

Round, square, or any other shaped dies can be held for the thread-milling operation either by an air-operated fixture or by other types of fixtures designed to suit the work. This machine has a capacity for threading pipe dies from 3/8 inch up to and including 2 inches. The machine, when provided with equipment for threading dies of the straight type, has a capacity range for handling from 3/4-inch to 2-inch regular standard size dies. 62



Coulter Machine Adapted for Milling Threads on Straight and Tapered Thread Cutting Dies

Columbia Power Press Brake and Squaring Shears

A motor-driven slide adjustment with both motor and controls readily accessible is an important feature of a new power press brake built by the Columbia Machinery & Engineering Corporation, Hamilton, Ohio. The slide can be adjusted out of parallel with the base, the magnitude of the adjustment being shown by indicators located at each end of the slide, as shown in Fig. 1.

The brake is operated by a multiple-disk friction clutch and a friction brake. The slide and base have been designed with a maximum permissible deflection of 0.001 inch per foot of machine width. The housings, slide, base, and cross tie-members are fabricated from rolled steel to provide strength, rigidity, and durability.

All gears are precision machine cut, and operate in oil. The eccentric shaft has eccentrics forged integral with the shaft. All main bearings are lubricated by a positive centralized lubricating system.

The brake has a capacity of 120 tons and operates at a speed of 30 strokes per minute. It will form mild steel sheet materials 7/16 inch by 4 feet, 5/16 inch by 6 feet, 1/4 inch by 8 feet, and 3/16 inch by 10 feet. This brake is regularly furnished with a flywheel for belt drive, but can be equipped for motor drive.

Another new development of this concern is the squaring shears shown in Fig. 2. This machine has longer shear blades than are normally required for cutting full-width material. These blades provide an opening on one end equal to the thickness of the material, thus eliminating tearing or nicking when notching or trimming sheets that are longer than the blades. The upper blade-holder has a heavy brace with provisions for readily adjusting horizontal alignment of the upper blade.

A six-jaw clutch of alloy steel with hardened faces and automatic cam stop operates on the squared end of the eccentric shaft. A centralized lubricating system provides positive lubrication for all main bearings. An easily read stainless steel scale is mounted in the shear table, and each machine is equipped with a mechanically operated automatic hold-down hav-

To obtain additional information on equipment described on this page, see lower part of page 202.

Fig. 1. Power Press Brake Built by Columbia Machinery & Engineering Corporation

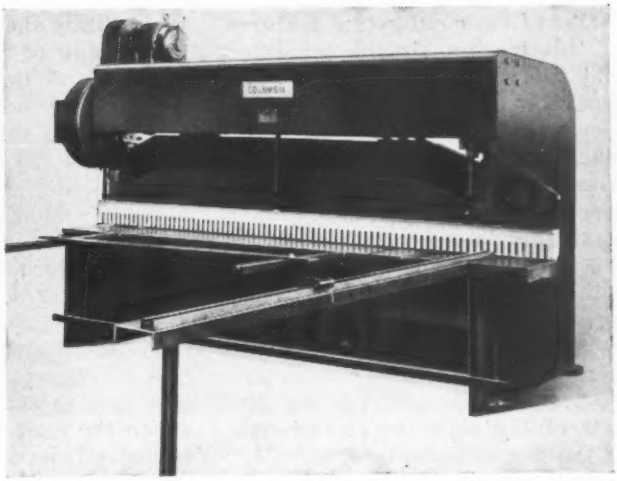


Fig. 2. Columbia Squaring Shears Designed with Extra Long Blades

ing individual high-compression spring compensating fingers and a finger guard.

The shears have a throat depth of 18 inches, and are made in three sizes. The 6-foot size will shear 1/4-inch mild steel at the rate of 60 strokes per minute, and the 10-foot and 12-foot sizes will shear 3/16-inch mild steel at the same speed. The shears are ordinarily furnished with flywheels for belt drive, but can be supplied with individual motor drive. 63

Fellows-Leominster Injection Molding Machine

The Fellows-Leominster plastics injection molding machine, now being built by the Plastics Division of the Fellows Gear Shaper Co., Springfield, Vt., incorporates several important new design features. It is ruggedly constructed, and is especially adapted for rapid operation. The molding capacity of this 1B-2 machine, shown in Fig. 1, is 2 ounces per shot, and the maximum molding speed is six shots per minute, the actual production rate depending on the product and the design of the mold. A plasticizing capacity of 45 pounds per hour is made possible by the ingeniously designed heating cylinder.

These features, together with the 30-inch casting area, 150-ton clamp, 5-inch stroke, and ample platen area for molds up to 10 1/2 by 13 1/2 inches make this machine well adapted for production runs on small hardware, jewelry, novelty, and industrial items. It can be used to advantage for short runs on larger products where the mold cost must be held to a minimum and where only the use of molds with comparatively few cavities is justified.

A patented central screw adjustment for even distribution of the clamping pressure minimizes flash and reduces the machine set-up time. The injection head is mounted on a movable slide, hydraulically actuated and mechanically locked during the molding operation, so that purging of the heating cylinder or clearing of a stuck sprue is easily accomplished, the head being withdrawn by simply turning a selector switch. Change-over from one material or color to another is simplified by the hinged hopper, which swings back and allows the positive-metering type of volumetric feed-slide to be readily removed for cleaning.

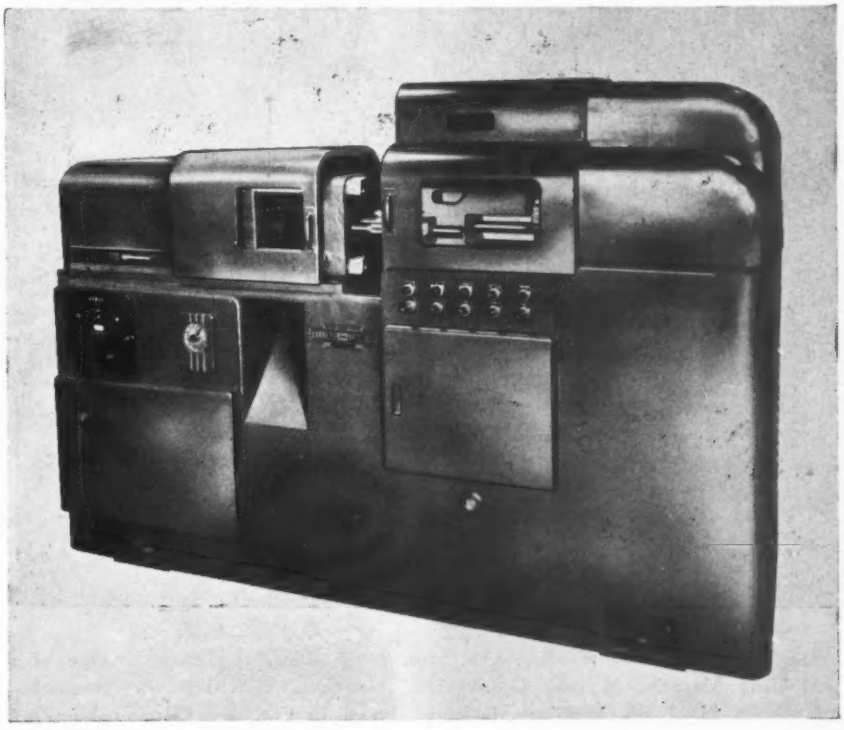


Fig. 1. Front View of Fellows-Leominster Injection Molding Machine Built by Plastics Division of Fellows Gear Shaper Co.

To obtain additional information on equipment described on this page, see lower part of page 202.

One of the outstanding features of this machine is the separator and the heating cylinder. The separator *S* is shown in the lower view of Fig. 2 removed from the machine. It will be noted that the outer surface of the "fins" on this separator is tapered, being smaller at the nozzle end, and made to fit the tapered bore *T* of the heating cylinder *H*. Between the separating fins are circular channels, as shown in sections *A–B* and *C–D*. The bottoms of these channels are located equidistantly from the axis of the separator. The ends of the fins are also tapered.

The tapered separator and cylinder design has been developed to facilitate the flow and uniform plasticizing of the material. The close fit of these two members prevents the lodging of any material between the fins on the separator and the walls of the heating cylinder, thus minimizing burning and discoloration of the product.

All hydraulic, electric, and water-cooling controls are within easy reach of the operator for both set-up and automatic operation. The speed and pressure of injection, as well as the speed with which the mold is closed, are controlled. Time controls are readily adjustable to the second by an Eagle Signal Microflex control, which provides for independent control of the injection plunger and the mold closing and opening time. The Leeds & Northrup Electromax temperature controller, with which the machine is equipped, has no moving parts and is vibration-proof, making it possible to locate it in the machine base so that the machine is a self-contained unit. The only connections required for installing the machine are the main power leads and water and drain pipes.

The machine is provided with a 1000 pounds per square inch Vickers hydraulic system, and all valves are mounted on the subpanel in the back of the machine, where they are readily accessible. The press end of the machine is completely enclosed by a sliding door having both hydraulic and electric interlocks, which prevent the press from operating when the door is open, thus insuring safety of the operator. The injection end, including the hopper, is also enclosed by a sliding door. This feature not only improves the appearance of the machine, but also provides protection from material contamination while molding. 64

Fig. 2. (Upper View) Injection Plunger P about to Force Charge of Molding Material M into Grooves in Separator S within the Heating Cylinder H of the Molding Machine Shown in Fig. 1. (Center View) Molding Material Forced into the Heating Cylinder, Causing the Plastic Material in the Heating Chamber to be Injected into the Mold through Nozzle N. (Lower View) Details of Separator S Shown in the Views Above

Harvill Hydraulic Convertible Die-Casting Machine

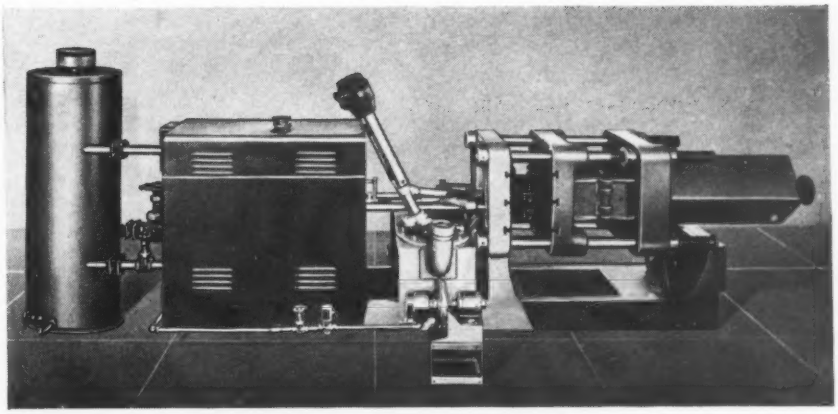
A new size and style of hydraulically operated die-casting machine has been announced by the H. L. Harvill Mfg. Co., Corona, Calif. This machine is of the heavy-duty type, and is convertible from normal cold-chamber to optional hot-chamber operation. When furnished for cold-chamber operation as shown, the equipment normally casts aluminum, magnesium, and copper-base alloys, although zinc, tin, and lead alloys can also be cast by the cold-chamber arrangement. The latter alloys are hand-ladled by the operator into the cold-chamber injection assembly from a holding furnace.

As many as 300 "shots" or injections of molten metal can be made per hour. The metal is injected into the die cavities under pressures ranging from 3400 to 11,800 pounds per square inch, the pressure on the metal being controlled by the size of the piston used. The machine is capable

To obtain additional information on equipment described on this page, see lower part of page 202.

of casting up to 11.6 pounds of aluminum alloy or the equivalent volume of other materials.

The hydraulic system is driven by a 15-H.P., 220-volt, 60-cycle, three-phase electric motor. The foot "shooting" switch is of the 220-volt, 60-cycle, single-phase type, 50-cycle equipment being optional. The vertical and horizontal dimensions of the die are 21 and 31 inches, respectively. The distance between the dies when open is 11 1/2 inches, and the maximum die thickness, with the dies closed, is 28 1/2 inches. The die has a locking pressure of 300 tons. The vertical and horizontal dimensions of the platen are 32 and 29 inches, respectively. The clearance between the bars is 21 1/2 inches vertically by 18 1/2 inches horizontally. The over-all dimensions of the machine are 3 feet wide by 21 feet long by 6 feet high. 65



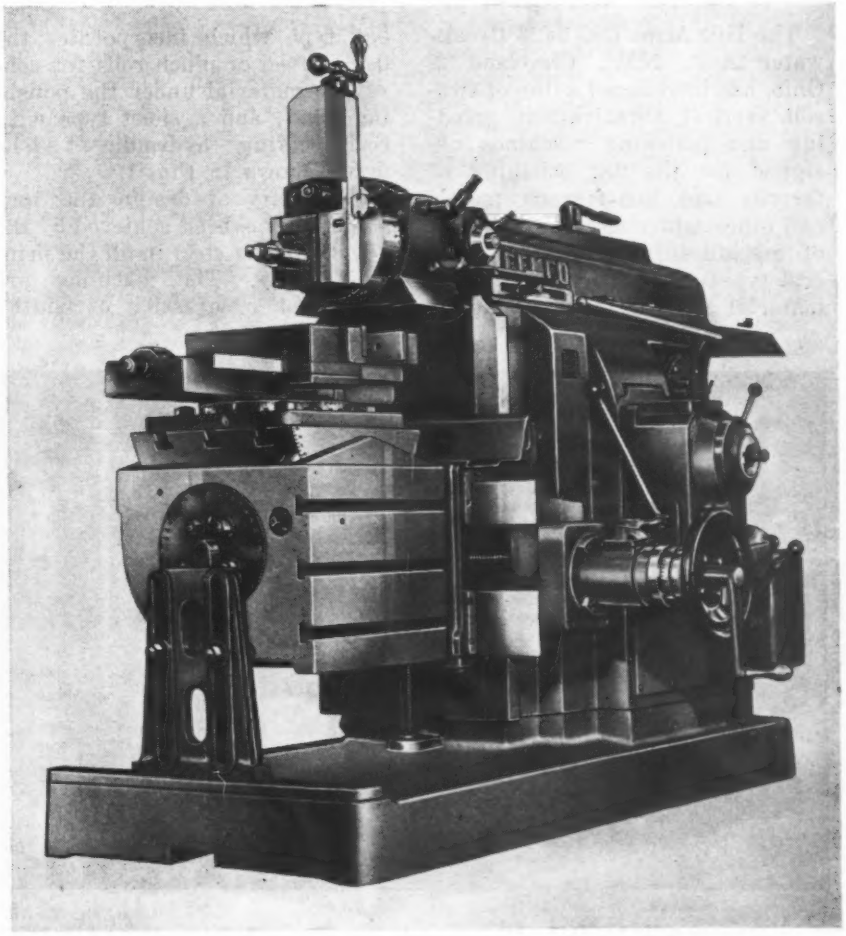
Harvill Hydraulic Convertible Die-casting Machine

"Gemco" Improved Multi-Purpose Shapers

Several new features designed to increase efficiency and facilitate operation have been embodied in the Gemco multi-purpose shapers built by the General Engineering & Mfg. Co., 4417 Oleatha Ave., Department M, St. Louis 16, Mo. Control of the power rapid traverse of the improved machine is now easily accomplished by a conveniently placed lever. This lever operates a positive type clutch built into the feed-mechanism housing. When the lever is shifted, the clutch engages the power rapid traverse, causing the worktable to automatically move away from the work or in a direction opposite to that of the power feed, thereby making it unnecessary for the operator to shift gears.

Selective feed or power rapid traverse for either horizontal or vertical movement of the worktable is easily obtained in the new model machine. The design permits the four-way control of feeds by means of a simple gear-shifting device at the operator's side of the cross-rail. The handwheel, normally used to position the work-piece, serves a twofold purpose, as it is also employed for gear-shifting. Pulling the handwheel out engages the vertical power feed and pushing it in engages the horizontal feed. Vertical feed, when employed, is geared down to approximately one-twelfth of the horizontal feed range.

The oil pump mounted on the side of the column is accessible from outside the machine and can be removed without disturbing any pipe connections. The filter is mounted on the side of the column to facilitate cleaning. 66



"Gemco" Improved Universal Type Shaper

Light-Weight Air Hose

A new light-weight air hose with rayon strengthening members and "Homo-Flex" construction has been designed by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. This new hose, designated the "Ray-Man," is said to be especially well adapted for bench work with small air-operated tools for which the ordinary air hose is too

To obtain additional information on equipment described on this page, see lower part of page 202.

Fig. 1. Grinding and Polishing Machine Brought out by the Hill Acme Co.

heavy and cumbersome. It is also said to be useful in industries employing compressed air for cleaning small areas such as the cavities of molds because of its ease of handling and flexibility. This hose is also available in an oil-proof type made of oil-resistant rubbers. Both types are made in sizes from 1/4 to 1/2 inch. 67

Hill Grinding and Polishing Machine

The Hill Acme Co., 6423 Breakwater Ave., N.W., Cleveland 2, Ohio, has introduced a line of two-roll vertical abrasive-belt grinding and polishing machines designed for the flat polishing of ferrous and non-ferrous metals and other materials. The new line of machines includes three general types—a strip type for strip material in coiled form; a plate or bar type which incorporates the use of feed or pinch rolls for conveying material under the polishing head; and a sheet type with reciprocating hydraulic table drive, shown in Fig. 1.

Simplicity of design and construction has been achieved by the use of welded steel in all the principal parts. The machines are built in a progression of widths up to a maximum of 60 inches. Endless coated abrasive belts 10 feet 6 inches long are used on all machines in the line. The short belt length is said to have definite economical advantages over the longer belts used on previous models.

The two-roll vertical polishing head is the same for all three types of machines. It consists basically of a dynamically balanced upper steel idler roll and a lower rubber-covered contact or work roll, over which the abrasive belt travels. The rubber-covered contact roll eliminates slippage of the abrasive belt, thereby increasing belt life. A steel work-supporting roll located directly below the contact roll can be raised and lowered by means of air cylinders to suit the particular grinding or polishing job being handled.

Both the plate and strip type machines can be used for multi-stage operations, in which a group of machines is placed in series, as shown in Fig. 2, for continuous polishing operations.

The outstanding features of these two-roll abrasive-belt grinding and polishing machines include centralized and easily accessible controls; no separate grinding machine required to redress the work roll which can be redressed in place by using a steel redressing plate furnished as standard equipment; and Hill pneumatic belt-centering device which can be adjusted to accommodate various abrasive belt widths. 68

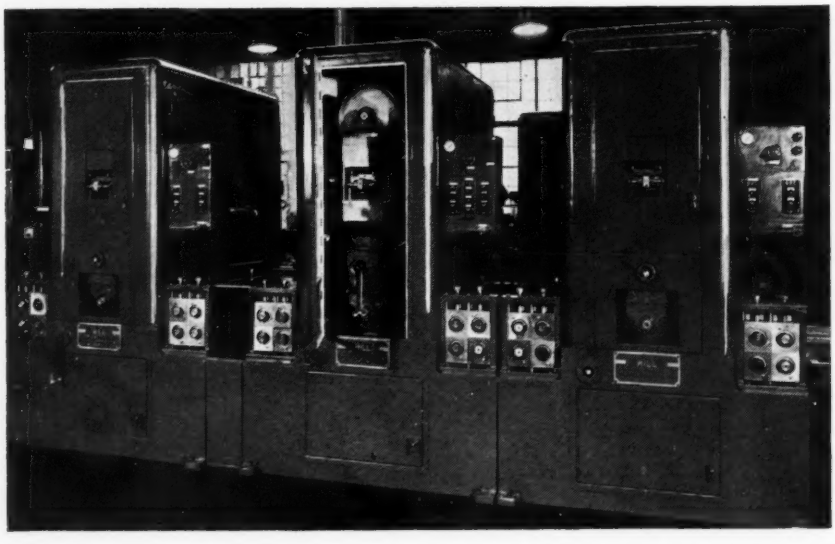


Fig. 2. Hill Vertical Abrasive-belt Grinding Units Assembled for Multi-stage Continuous Polishing Operations

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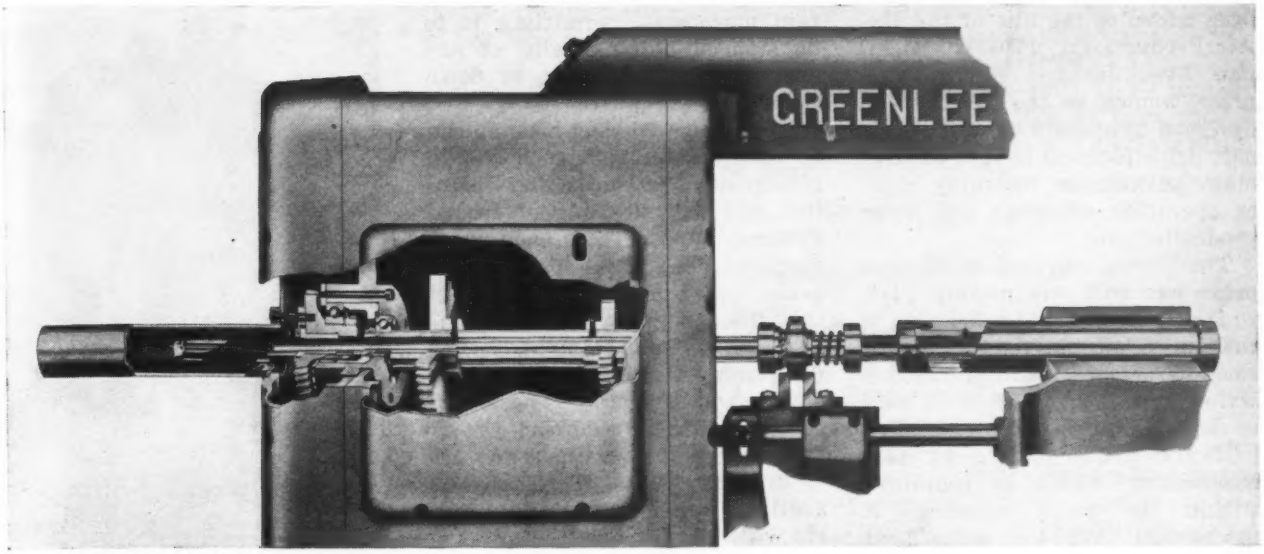


Lead-screw Threading Equipment Developed for Use on Greenlee Six-spindle Automatic Screw Machines

Lead-Screw Threading Equipment for Greenlee Six-Spindle Automatic Screw Machines

New simplified equipment has been designed to speed up the production of precision-threaded parts on the six-spindle automatics built by Greenlee Bros. & Co., 1867 Mason Ave., Rockford, Ill. This new equipment, designed to handle lead-screw threading, eliminates many secondary operations, and is particularly adapted for use in the production of pieces requiring threads with a very accurate lead. The equipment is to be exhibited at the coming Machine Tool Show at the Dodge-Chicago plant.

The new equipment is a combination cam and lead-screw operated mechanism and can be used in the third, fourth, and fifth positions of the six-spindle machines. It is available for machines of 1-, 1 5/8-, and 2-inch bar capacities. No special cams are required, standard cams serving to operate the quick-approach and rapid-return stroke attachment. The attachment incorporates a relieved type lead-screw threading spindle of original design, which has several distinct advantages over the earlier types of lead-screw equipment built by this company for its screw machines.

The lead-screw attachment consists of a threading spindle unit, a removable lead-screw having an outside diameter of 1 inch, a bronze nut, safety shear keys, an outboard bearing support, and a yoke for operating self-opening die-heads. The threading spindle drive-shaft is about 10 inches longer than the drive-shaft of threading attachments previously used on these machines.

A relieved section on the threading spindle drive-shaft directly ahead of the removable lead-screw permits the use of the standard cam-operated lever to effect a quick-approach stroke and rapid return when threading to a shoulder or tapping a deep hole at some distance from the end of the work. At the end of the quick-approach stroke, the lead-screw on the end of the drive-shaft threads itself into a bronze lead-screw nut. This controls the threading-in and also the threading-out action of a tap or die-head.

At the end of the feed or threading-in stroke, the shifting of a duplex clutch changes the speed of the threading spindle. This causes the lead-screw to thread itself out, withdrawing the tool from the work. The standard cam-operated feed-lever then returns the threading spindle quickly to the starting position. The lead-screw and nut are engaged only during the in and out threading operations.

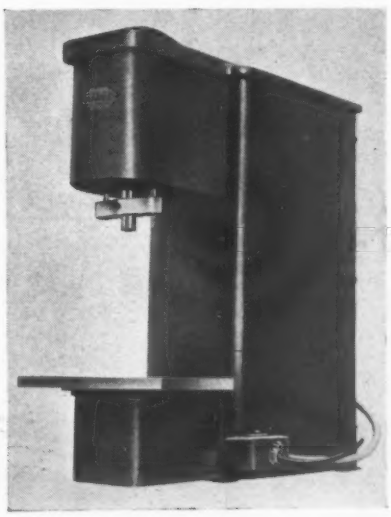
To change over the machine for cutting threads of different leads, it is only necessary to slip in a new lead-screw and nut having threads that correspond with those to be produced on the work. Thus any type of Class 1, 2, or 3 threads can be obtained.

This new threading equipment can also be set up to handle conventional cam-operated threading work without changing the threading drive spindle. For ordinary work requiring Class 1 or Class 2 threads, it is only necessary to remove the lead-screw and nut from the threading spindle drive-shaft and adjust the standard threading box cams to meet the stroke requirements. Thus both types of threading jobs can be handled.

Equipment is available which makes it possible to readily install this mechanism on Greenlee six-spindle automatics now in use.—69

Air-Hydraulic Press

A new air-hydraulic press developed to perform practically all types of pressing operations, has



Air-Hydraulic Press Brought out by Hy-Air Products Co.

To obtain additional information on equipment described on this page, see lower part of page 202.

been added to the line of the Hy-Air Products Co., 1707 W. Michigan Ave., Jackson, Mich. This press, known as the "Hapco," is designed to operate on an entirely new principle, and is said to offer many advantages, including higher operating efficiency and lower production cost.

The power mechanism of this press has only one moving part, which is designed to float on a cushion of oil and thus provide a smoother, more easily controlled action. Air consumption is said to be reduced to approximately half the usual volume by this mechanism, which is contained within the press housing. A mechanical stroke adjustment provides positive control of the ram movement, permitting it to be stopped automatically at any desired point in the up or down stroke.

The fabricated steel housing can be easily adapted to such special requirements as horizontal operation and the mounting of special fixtures, hopper feeds, and work supports. The adaptability of the press is also increased by the fact that the full power of the ram is also available on the up stroke for performing such operations as indexing and stripping. These, and other operations requiring power, can be performed without the use of auxiliary units. This press is available in 2 1/2- and 5-ton models with strokes of either 2 or 5 inches. 70

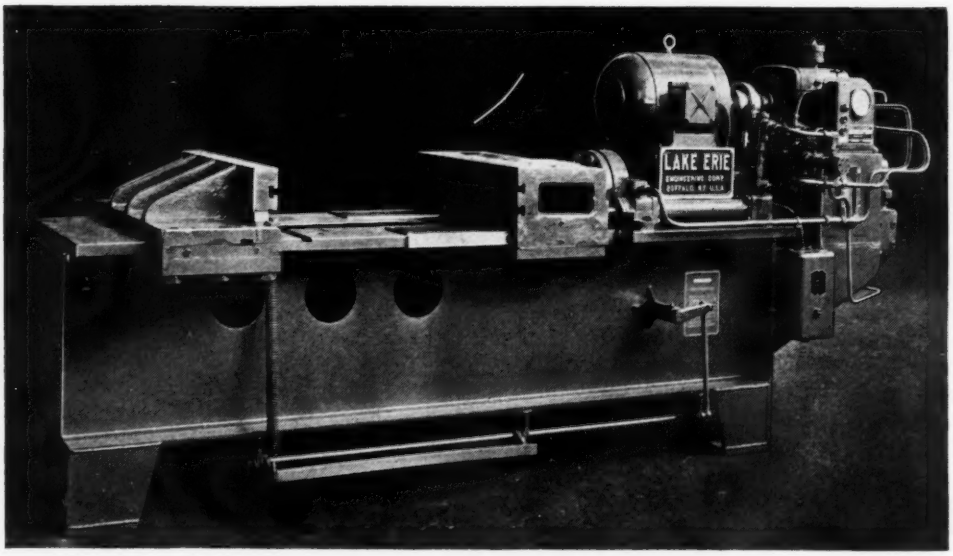
Clearing All-welded Press

Lake Erie Hydraulically Operated Bulldozers

Hydraulically operated bulldozers are being built in a wide range of types and sizes for both standard and special applications by the Lake Erie Engineering Corporation, 170 Woodward Ave., Buffalo 17, N. Y. These machines, designed as compact, self-contained units, can be placed in operation or moved to new locations when necessary with a minimum of delay and expense.

The new bulldozers are foot-treadle controlled, pressure on the treadle serving to advance the machine cross-head. The stroke can be stopped and the ram returned at any point merely by releasing the treadle. Auxiliary and double-acting traverse cylinders give rapid approach and return movements to the cross-head, and any part of the stroke can be used with full pressure at any specific point. The hydraulic system employed is designed to eliminate the danger of breakage through overloading.

The bulldozer frames are constructed of heavy welded sections to reduce deflection under full load to a negligible amount and to insure close alignment of the dies at all times. The ways are of hardened steel and are highly resistant to wear. Standard equipment includes adjustable-stroke stops; automatic adjustable control of the pumps; air and oil filters; and pressure gages. 71



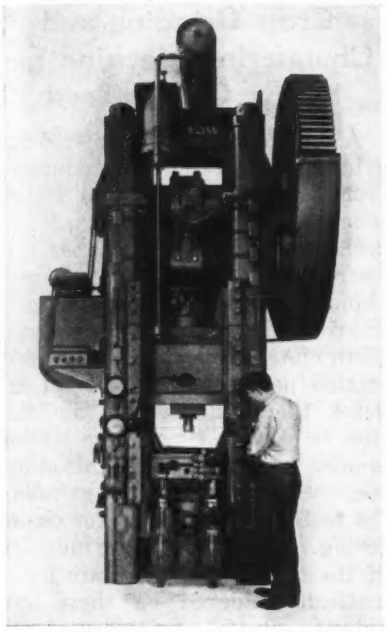
Lake Erie Horizontal Hydraulically Operated 50-ton Bulldozer

Clearing Light Presses

Welded steel presses ranging in capacity from 60 to 250 tons have been added to the line of the Clearing Machine Corporation, 6499 W. 65th St., Chicago 38, Ill., supplementing the larger sized presses previously manufactured. The purpose is to provide a line of standard machines that can be made quickly available for delivery in an extremely wide range of sizes and capacities. Bed widths range from 36 to 108 inches, in increments of 6 inches, and any of these sizes can be had with bed depths of from 28 to 44 inches. Stroke lengths vary from 3 to 18 inches, and shut heights similarly vary over a wide range.

Series S presses are of the double-crank type with twin end drive; most of the sizes can be furnished with either single- or double-geared drives. Other features include a barrel type slide adjustment that can be manually or power operated; controls that automatically lock or unlock the adjustment drive and prevent over-adjustment of the slide; an air friction clutch that is interlocked with a spring-actuated brake; and air-counterbalanced cylinders machined for air cushions. 72

To obtain additional information on equipment described on this page, see lower part of page 202.



Bliss Briquetting Press for Large Powdered-metal Parts

Bliss Briquetting Press for Powdered-Metal Production

A 345-ton mechanical press has been developed by the E. W. Bliss Co., 450 Amsterdam Ave., Detroit 2, Mich., for the production of large or irregularly shaped parts from powdered metals. Embodying a floating die table, core rod, and stripper, the press is said to be capable of producing large complex parts that are beyond the range of either single-action mechanical or hydraulic type presses.

The slide can be adjusted for strokes of from 5 to 10 inches, and for speeds of from six to nine strokes per minute or nine to eighteen strokes per minute. The change from the low to the high speed range is made by shifting a dog clutch in a two-speed gear-box by means of an external lever, while speed adjustments within the low or high range are made with an adjustable-speed motor.

The mechanical cycle can be "inched" for setting up, "single stroked" for try out, or run continuously for production. A flexible electrical timing device makes possible many combinations of the three lower motions, and the table and core rod can be kept stationary if desired. A hopper feed arrangement operated by a cam on the slide mechanism automatically fills the die and ejects the work.

The capacity of the slide is 345 tons; die table, 120 tons; core rod, 60 tons; and stripper, 75 tons. The stroke of the slide is 10 inches; die table, 3 inches; core rod, 3 inches; and upward ejecting stripper, 6 inches. 73

Beatty Horizontal Hydraulic Bulldozer

The Beatty Machine & Mfg. Co., Hammond, Ind., has brought out a new 400-ton welded steel horizontal bulldozer for use in structural shops, implement plants, car shops, and general application throughout the heavy metal-working industry. The machine has a high operating speed in relation to its heavy size, and being horizontal, does not require the dies to be shimmed or adjusted minutely for safe operation.

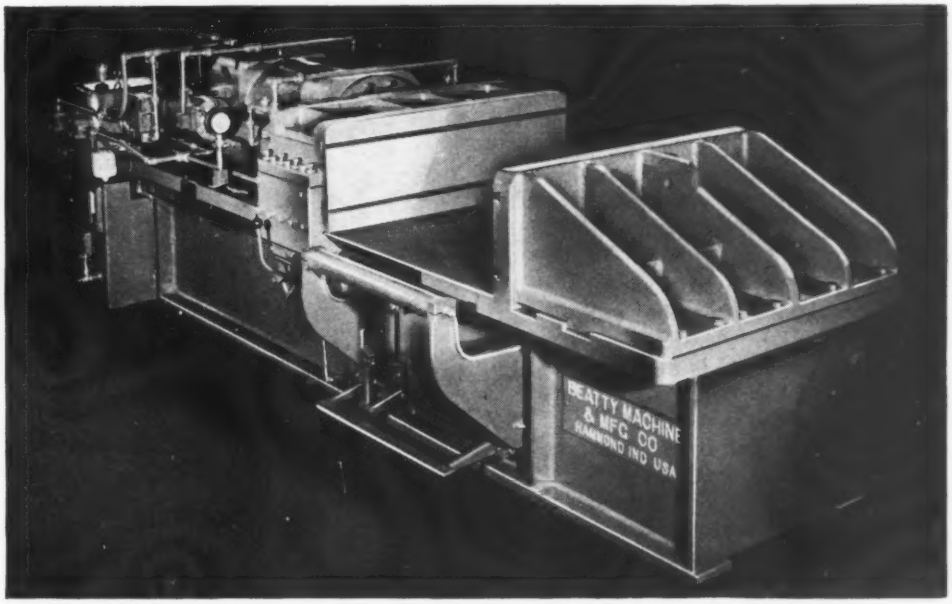
This bulldozer has a stroke of 24 inches and a maximum opening of 60 inches. Provision is made for shifting the resistance lug to provide a 48-inch opening. The die space, or closed opening, is 24 inches, or 12 inches with the lug shifted. The ram and resistance lug are 20 by 60 inches. The advance operating speed is adjustable from 0 to 144 inches per minute, the pressing speed from 0 to 18 inches per minute, and the return speed from 0 to 190 inches per minute.

The speed is controlled by the amount of movement of the hand-lever or foot-pedal. Stroke-adjusting collars allow the machine to be set for a predetermined ram travel. Thus if a 12-inch stroke is required, the unit can be set to automatically reverse at the end of a 12-inch travel.

The machine is furnished with the necessary double-acting rapid-advance cylinder and variable-pressure variable-delivery pump mounted on a welded steel oil tank and with valves, hand-levers and foot-pedals on both sides of the machine. 74

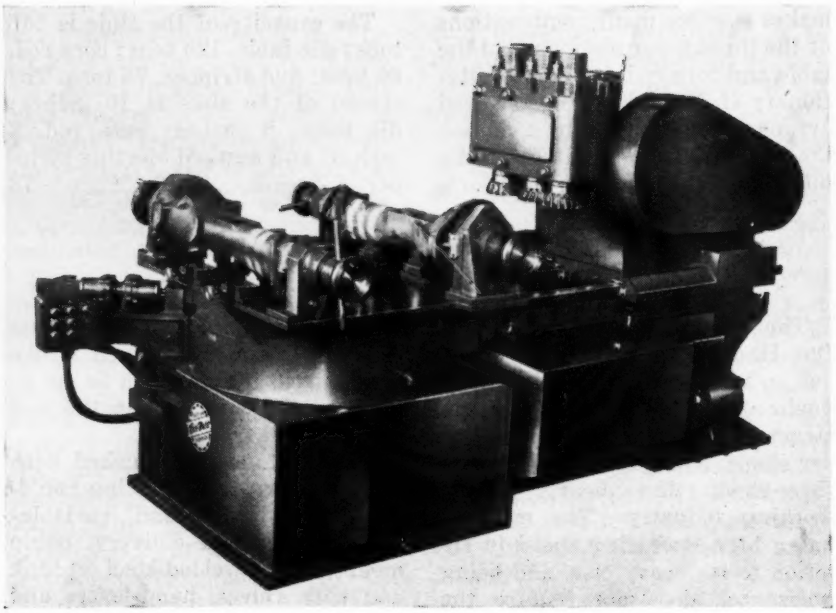
Grinding Coolant

A new grinding coolant known as "Wheelyfe 85," has been developed by the Bee Chemical Co., 63 E. Lake St., Chicago, Ill. This coolant gives protection against corrosion, and does not become rancid even after long use. Consequently it will not load the wheel, and better grinding action results. For best results, it is recommended that the coolant be used in a solution made by mixing it with water in the proportion of one gallon of coolant to thirty gallons of water. 75



Hydraulic Bulldozer Built by Beatty Machine & Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 202.



Vertical Milling Machine Developed by the Davis & Thompson Co.

Davis & Thompson Vertical Milling Machine

The latest addition to the line of the Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis., is a Type VMI vertical milling machine which is adapted for the production milling of the two top pads on a clutch housing. Three cutter-spindles are provided, two of which are equipped with interlocking cutters. The cutter-spindles are driven by a 20-H.P. motor, through a worm and worm-wheel and a gear train which furnishes spindle speeds of from 82 to 328 R.P.M. Each of the cutter-spindles has a micrometric vertical adjustment of 1 1/4 inches.

A two-station hand-clamping fixture is mounted on a hydraulically driven indexing table. The work is located by universal pins which enter cored holes at each end. In order to facilitate indexing, the table is raised a few thousandths inch by means of a hydraulic cylinder, and it is locked in place by the same hydraulic cylinder for the milling operation.

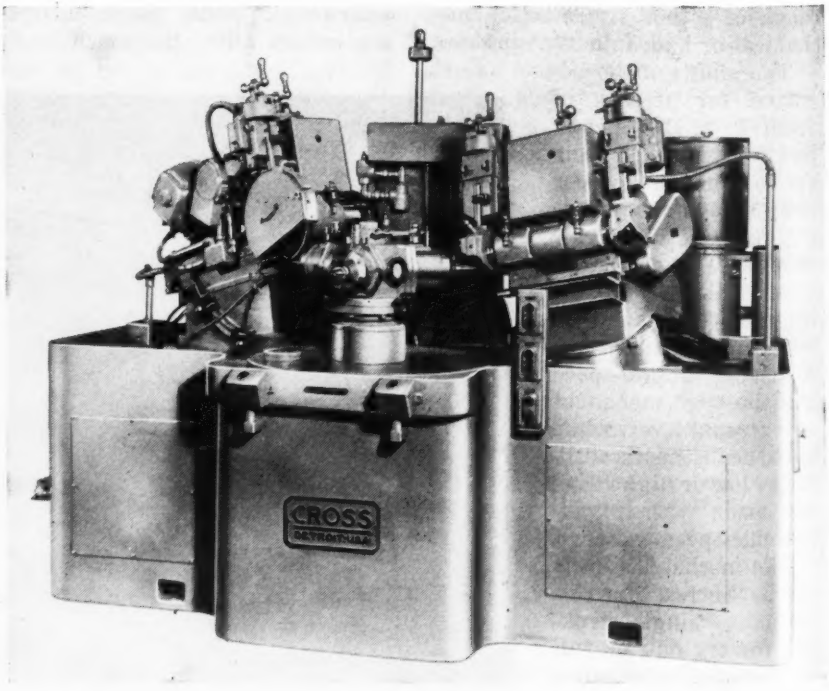
The milling head is mounted on a bed having hardened and ground steel ways, movement of the head being accomplished by a hydraulic cylinder. The operating cycle of the machine is fully automatic, being started by simply pressing the button that controls the head drive and pump motors. After these motors have been placed in operation, a piece is inserted in the fixture and the actual machining operations commenced by pressing the start button. During the automatic machining cycle a new piece is placed in the second work-holding station.

Production ranges from 40 to 80 pieces per hour, depending upon the speed of the operator in loading and unloading the work. The complete machine weighs about 20,700 pounds. 76

Cross Grinding and Chamfering Machine for Spring Clutch Teeth

A special machine designed for grinding teeth in spring clutches from the solid metal and simultaneously chamfering one side has been developed by the Cross Co., Detroit 7, Mich. The new machine, operated by one man, has a production rate of 200 eight-tooth clutches per hour. A three-station power-operated turret indexes the work-pieces from station to station. The first station is used for loading and unloading, the second station for grinding the teeth, and the third for chamfering. In addition to the indexing of the turret, the parts are automatically indexed on their own axis at each station from one tooth to the next.

When the work-clamping lever is released, the work stops rotating, thus providing for quick, easy loading and unloading. The grinding wheels are automatically dressed while the turret indexes, the size being maintained by automatically compensating for the amount dressed from the grinding wheel. The machine can be adjusted to accommodate clutch plates having any desired number of teeth or for any required tooth size or angle within its capacity range. 77



Special Cross Machine for Grinding and Chamfering Spring Clutch Teeth

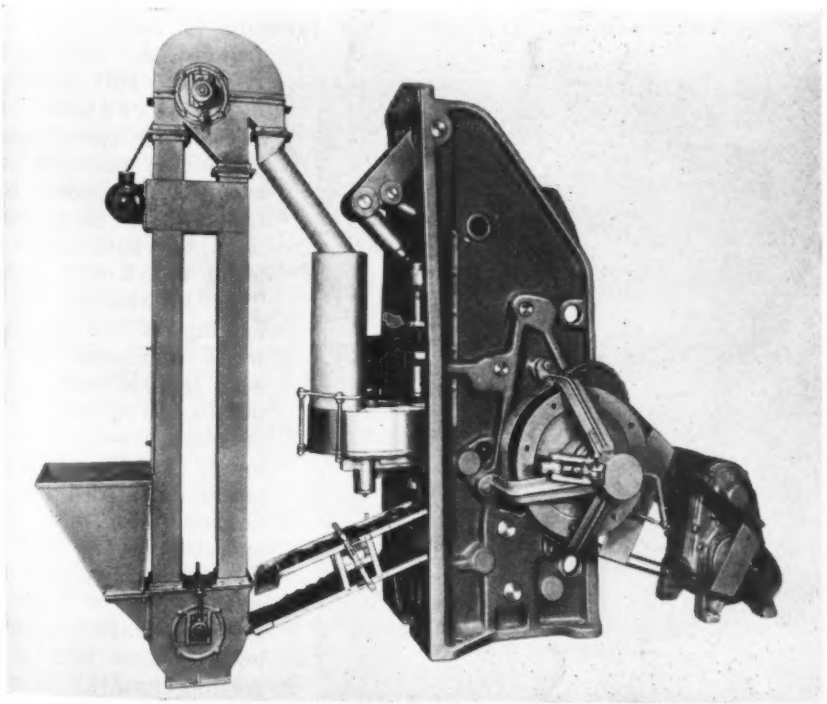
To obtain additional information on equipment described on this page, see lower part of page 202.

Plastics Preforming Press

The Kux Machine Co., 3925 W. Harrison St., Chicago 24, Ill., has developed a press specifically for the production of preforms or tablets from "high bulk factor" plastic materials which cannot be automatically tableted on standard presses because of their high compression ratios and poor feeding characteristics. This includes materials having compression ratios as high as 12 to 1—that is, 12 inches of material can be compressed into a tablet 1 inch thick. Such materials can be automatically compressed in this machine with the variation in weight between tablets held to very close limits—in most cases within less than 5 per cent.

The automatic and continuous cycle gives a production rate up to 20 tablets a minute on the model No. 67 machine with pressures as high as 75 tons. Materials such as asbestos for brake linings and impact type plastics with canvas or rag fillers can be tableted on this machine.

The maximum total pressure capacity of the press is 75 tons. It will produce tablets up to a maximum diameter of 4 inches with a maximum fill depth of 8 inches. It requires a 10 H.P. motor, a floor space 6 by 12 feet, and weighs 10,000 pounds. 78



Plastics Preforming Press Brought out by the Kux Machine Co.

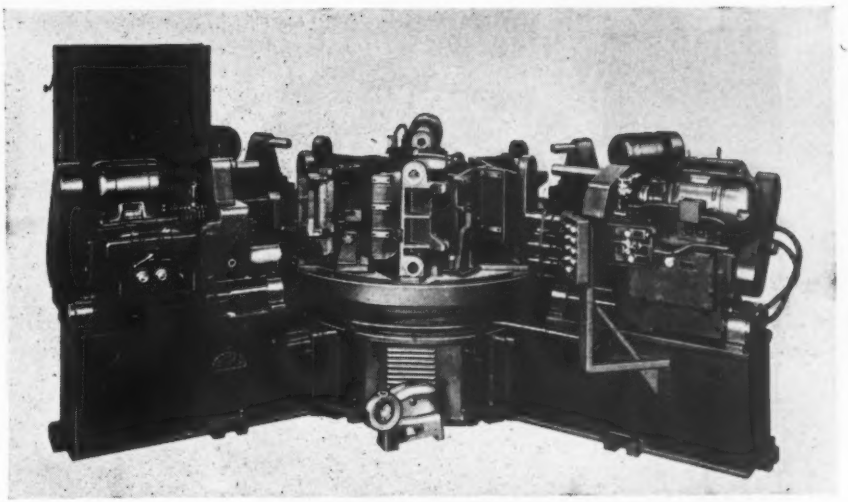


Fig. 1. Special Machine Designed for Machining Steering-gear Housings by the Snyder Tool & Engineering Co.

Snyder Special Machines for Operations on Steering-Gear and Rear-Axle Housings

Twenty-two machining operations are performed on cast-iron steering-gear housings in the special automatic machine shown in Fig. 1, which was designed and built recently by the Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich. Drilling, boring, chamfering, spot-facing, reaming, and tapping operations formerly handled on separate machines are now performed in a completely automatic cycle on this machine.

The work-holding fixtures are mounted on an electrically driven automatic six-station Geneva-motion indexing table, and the housings are machined by five self-contained Snyder units. One housing is completed every fifty seconds, the parts being clamped in place manually. Both high-speed steel tools cutting at 90 feet per minute and tungsten-carbide tools cutting at 240 feet per minute are employed. The boring tools are flange-mounted, and the drills and reamers are held in adjustable adapters.

The special machine shown in Fig. 2 is another recent development of this company. This machine performs in a single automatic cycle a number of drilling operations on truck rear axles. The entire work cycle, including clamping, drilling twenty-one holes, and releasing the work, requires fifteen seconds. Operating in automatic sequence, a movable bushing plate and two individually actuated hydraulic clamps locate and clamp the work-piece in the fixture. The hydraulic clamps are mechanically locked to hold the parts securely in place while machining.

The work is located by two opposed pilots which enter the banjo face bores. One pilot is stationary, while the other is movable and is wedge-locked in place by a separate cylinder after entering the bore. The twenty holes in the banjo faces are drilled by two Snyder self-contained hydraulic

To obtain additional information on equipment described on this page, see lower part of page 202.

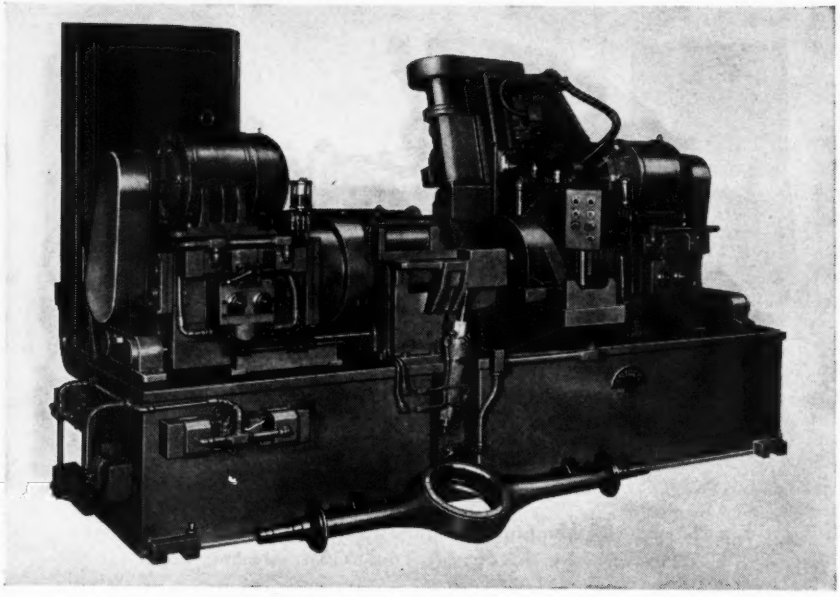


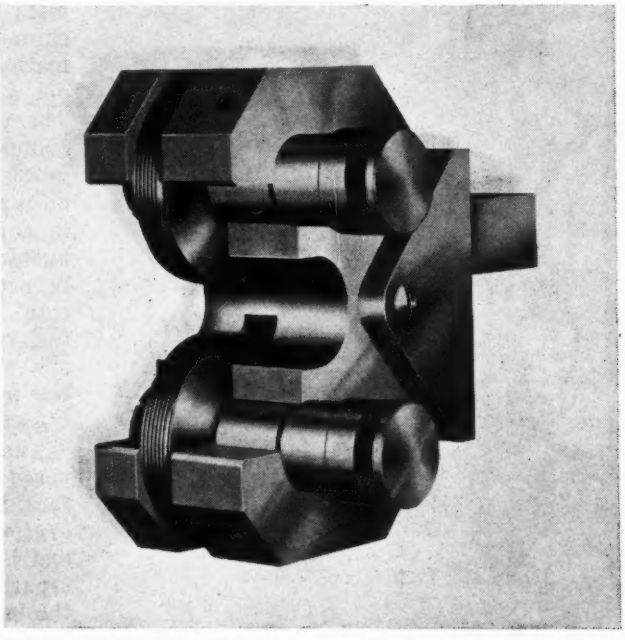
Fig. 2. Snyder Special Automatic Machine for Drilling Truck Rear-axle Housings

units, each carrying a ten-spindle head, which are mounted opposite each other. A single-spindle unit mounted at an angle drills the breather hole. This unit is also hydraulically actuated.

High-speed steel drills are employed, operating at 60 surface feet per minute with a feed of 0.008 inch per revolution. Hydraulic feed for all tools includes rapid advance to working position, working feed, and rapid return. Coolant equipment, hydraulic tank, and motor are enclosed in the welded-steel base. 79

"Lanroll" Thread-Rolling Attachment for Automatic Screw Machines and Turret Lathes

The Landis Machine Co., Waynesboro, Pa., has developed a thread-rolling attachment known as the "Lanroll," which can be furnished for application to practically any standard make of automatic screw machine or turret lathe. This attachment is designed to provide a fast, economical method of generating screw threads on screw machine and turret lathe work without requiring the work to be rechucked. Threads that are in inaccessible positions or that cannot be cut by a die-head in the normal manner because of the interference of shoulders can be readily produced by this new rolling attachment. It also facilitates holding closer tolerances between the thread and other sections of the work. Generally, the thread-rolling operations can be performed at the same work speeds employed for other machining operations.



"Lanroll" Thread-rolling Attachment for Screw Machines

The thread-rolling attachment is primarily a single-purpose tool, and must be designed to suit the diameter, pitch, form, and length of thread to be rolled, as well as the machine on which it is to be used. It can be employed to roll threads of any length up to 1 1/2 times the diameter of the thread. Typical parts on which threads can be rolled with the "Lanroll" attachment include pipe bushings, pipe plugs, flush rings, spark-plug bodies and studs. 80

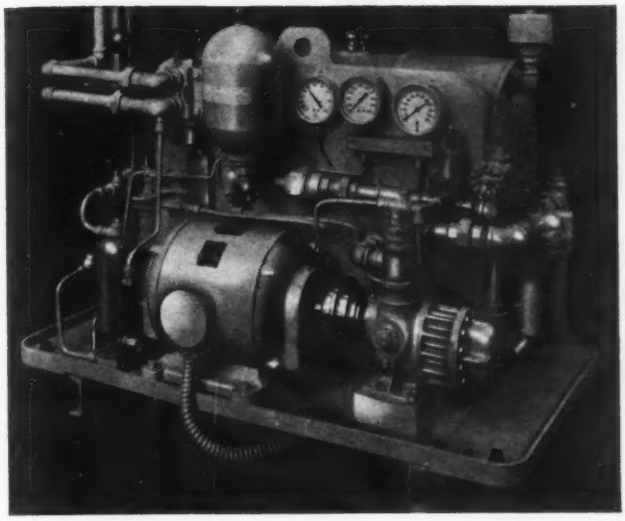
"Seco" Power Package

A compact power and control unit, ready to be connected to a hydraulic press, has been placed on the market by the Simplex Engineering Co., Zanesville, Ohio. This new power package has been designed to combine in one complete unit all the essential components for automatic "high-low" hydraulic press operation. It is only necessary to couple the high- and low-pressure circuits of this unit to the press.

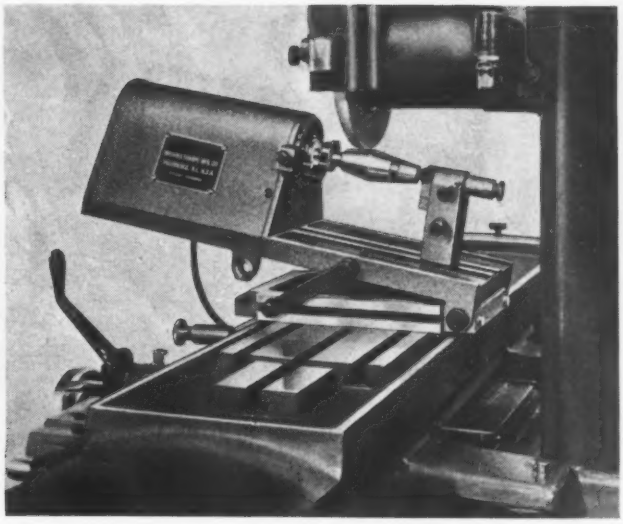
A high-volume low-pressure pump rapidly closes the press through the daylight opening range and a "Seco" radial high-pressure pump supplies the final squeezing action. This transition from low to high pressure is automatic, and when the predetermined high pressure is reached, it is trapped and held until released. This feature is an advantage in molding operations. When the pressure is trapped, the press is isolated from the power unit, the pumps operating without load. This intermittent unloading of the pumps while maximum pressure is held makes it possible to operate two or more presses alternately by the same power unit. All that is necessary for multiple operation is an additional control valve and check-valves at each press. A single control lever governs both operating circuits.

This fluid power unit is available in five mod-

To obtain additional information on equipment described on this page, see lower part of page 202.



"Seco" Fluid Power Package Unit for Operating Hydraulic Presses



Brown & Sharpe Cylindrical Grinding and Indexing Attachment for Surface Grinder

els covering high pressures of from 2000 to 6000 and low pressures of from 300 to 350 pounds per square inch. 81

Brown & Sharpe Cylindrical Grinding and Indexing Attachment

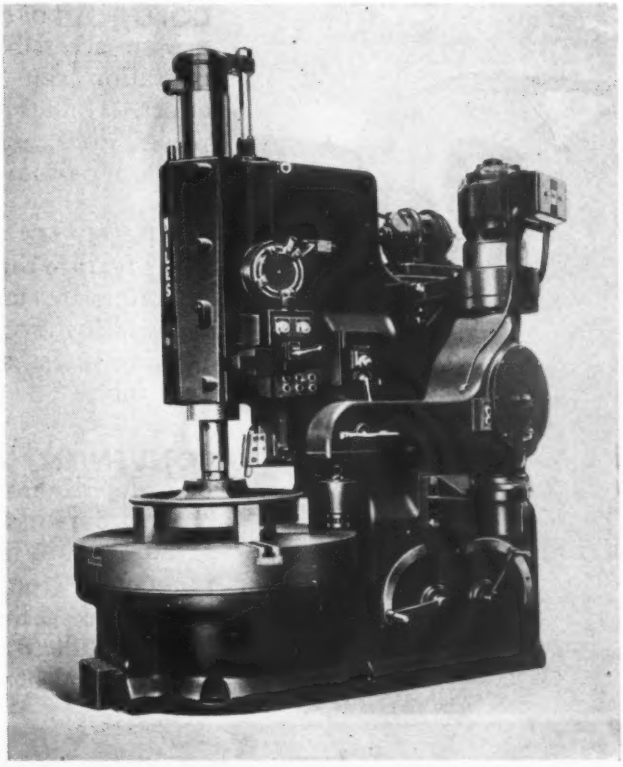
The Brown & Sharpe Mfg. Co., Providence 1, R. I., has brought out a cylindrical grinding and indexing attachment designed to adapt surface grinders for the dry grinding of small cylindrical work and work requiring indexing. Straight cylindrical and tapered work can be ground between centers, and parts 1/2 inch in diameter or less can be held in the indexing spring chuck. Spring collets for the chuck accommodate round work from 1/8 to 1/2 inch in diameter, inclusive.

A representative application of this attachment consists of grinding tapered work between centers in the manner shown in the illustration. The attachment can be readily mounted on the grinder table in a horizontal position for cylindrical grinding. The index-plate can be easily locked or released and can be employed for grinding parallel flats, square and hexagonal pieces, etc.

The motor is completely enclosed, and the ball bearings in the index-head and spring chuck are permanently lubricated and sealed. The attachment centers will swing work 6 inches in diameter and 5 1/4 inches long. The maximum grinding angle is 45 degrees. 82

Niles Automatic Hydraulic Car-Wheel Borer

The latest hydraulic car-wheel borer brought out by the General Machinery Corporation, Niles Tool Works Division, Hamilton, Ohio, has been designed to rough, finish-machine, chamfer the bore, and face the hub of cast-iron or steel car wheels in a five-step automatic cycle.



Niles Hydraulic Car-wheel Borer

After the feed dials are set for the desired operation, it is only necessary to operate three controls to bore individual wheels. The wide range of feeds available makes it possible to select the most efficient one for a particular speed and kind of material.

The machine table is 53 inches in diameter, and will chuck wheels up to 48 inches in diameter. When standard jaws are used with the smallest wheel table, the machine will chuck wheels 29 inches in diameter, and with the jaws reversed, it will handle wheels 15 inches in diameter. The chucks are equipped with five jaws. The table has six speeds, and its top surface is located 30 inches from the floor. The ver-

To obtain additional information on equipment described on this page, see lower part of page 202.

EVERYTHING WITHIN EASY REACH . .

CONTROLS of the No. 5 Plain Grinding Machine are so accessible that maximum efficiency of operation can be maintained with minimum effort. The table tray is a handy place for work pieces, dogs, and tools. Recessed base provides ample leg-room when operators are seated.

CONVENIENT HEIGHT of this machine is another feature that encourages top efficiency when operators are standing at their work. This advantage is illustrated at the left where grinding main bearing surfaces on small crankshafts is a quick, easy job.

CONVENIENT OPTIONAL EQUIPMENT may be ordered with the No. 5 Machine—Independent Automatic Cross Feed (for straight-in-feed grinding); Wheel Spindle Reciprocating Arrangement (for better finish at a faster rate with less wheel truing on plunge-cut grinding); and Wheel Slide Rapid Travel (for easy insertion and removal of work).

BROWN &

FOR NEW PRODUCTION RECORDS ON CLOSE-TOLERANCE CYLINDRICAL GRINDING JOBS

No. 5 PLAIN GRINDING MACHINE

The No. 5 is a small machine developed particularly for rapid grinding of small parts on a production basis. It is also economical for grinding small parts in toolrooms having sufficient work to warrant a plain grinding machine. Here's why . . .

Accurate sizing to .0001" on work diameter.

Close-fitting spindle cuts spark-out time to a minimum.

Automatic starting and stopping of headstock and coolant pump controlled by cross feed handwheel . . . simplifies and speeds operations.

Automatic lubrication to lessen wear and reduce maintenance.

The No. 5 Plain Grinding Machine is made in two sizes . . . 3" x 12" and 3" x 18". For greatest efficiency on high production, work speeds and table speeds are designed for diameters up to about 1". Get complete details on this machine that *saves time for production* and takes *less time for setting up*. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

Visit our Booth No. 505 at the Machine Tool Show

SHARPE

B·S

tical boring ram has a travel of 40 inches, and holes up to 9 15/16 inches in diameter can be bored.

For use with high-speed steel cutting tools, the machine can be furnished with a 15-H.P., constant-speed, alternating- or direct-current motor, which provides a table speed range of from 7 to 30 R.P.M. For use with carbide cutting tools a 30-H.P., constant-speed, alternating- or direct-current motor can be provided, which gives a table speed range of from 30 to 125 R.P.M. The machine can also be equipped with a 15-30-H.P., two-speed, alternating- or direct-current motor, which provides a range of table speeds of from 7 to 125 R.P.M. 83

Grenby Universal Grinding Machines

The Grenby Mfg. Co., Whiting St., Plainville, Conn., has brought out two new hydraulic grinders, one a universal external grinder, shown in the accompanying illustration, and the other a universal internal grinder. Either machine can be equipped with both types of heads.

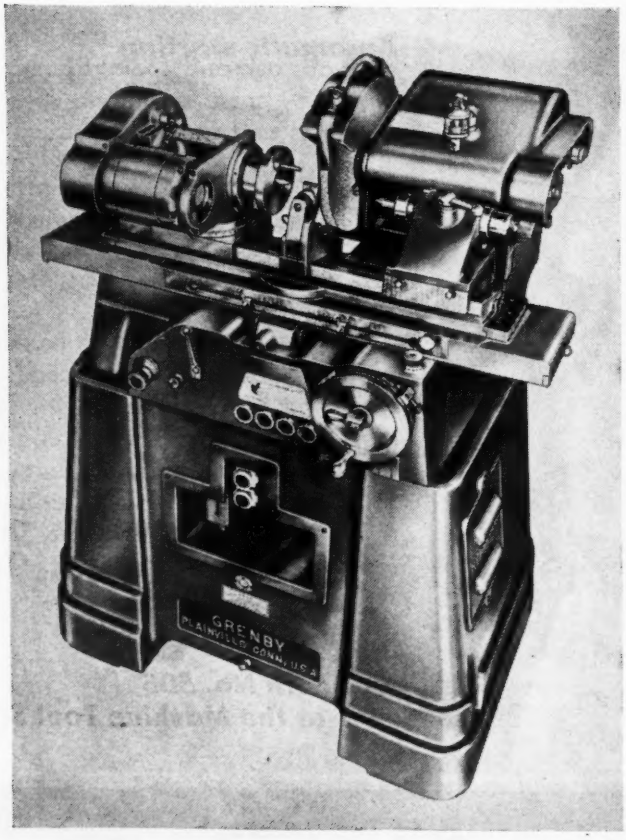
The external grinder has a capacity for handling work 3 inches in diameter by 10 inches long between centers. The internal grinder has a capacity for grinding holes 3 inches in diameter by 4 inches long. Both machines can be used to grind work up to the full swing over the table, which is sufficient to handle work 9 inches in diameter. These grinders are intended primarily as toolroom equipment, but the accurate stops for maintaining size, the lever collet-closer, hydraulically operated table, semi-sizing diamond dresser, and other features make them well adapted for production work. They differ from the older hydraulic models in that the table is hydraulically operated even when manually controlled. This reduces operator fatigue and increases production.

The live-spindle work-head takes 5C 1-inch collets, and swivels 90 degrees either side of the center. The grinding-wheel head swivels 15 degrees and a 3/4-H.P. motor drives the 10- by 1-inch external wheel or the 15,000-R.P.M. and 32,000-R.P.M. internal grinding spindles.

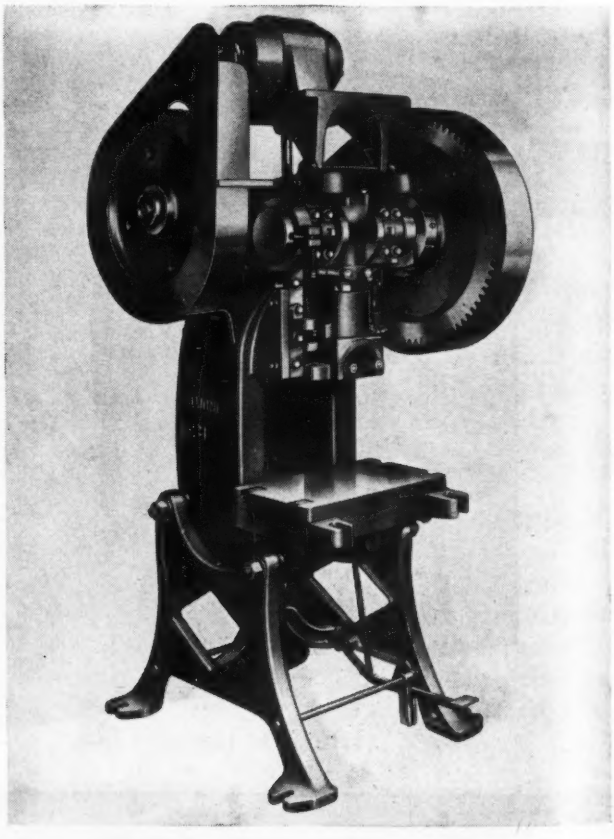
Hand and power cross-feed with 0.0001-inch graduations are standard equipment. The bed ways are hand-scraped flat and square to an accuracy of 0.0002 inch, and are automatically oiled from the hydraulic system. The table has stepless speed changes ranging from 0 to 100 inches per minute, and can be set to oscillate a full 10 inches or as little as 1/32 inch. The power cross-feed can be used at either end of the stroke. 84

Diamond Improved Back-Geared Punch Press

A back-geared 31-ton punch press of improved design has just been announced by the Diamond Machine Tool Co., Los Angeles, Calif. This press differs from the previous 30-ton model in that it has back-gears and a frame of more rigid design. The bed area from front to back is 13 inches, and from right to left 22 inches. The regular stroke is 3 inches, although machines with longer or shorter strokes can be furnished if desired. The press has an over-



Grenby External Grinding Machine



Diamond Back-geared Punch Press

To obtain additional information on equipment described on this page, see lower part of page 202.

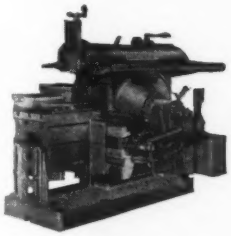
Shape - Form - Shear

...ON A "CINCINNATI"

Today Cincinnati Shapers are more efficient than ever before with heavier cutting capacities and speeds up to 200 strokes a minute on the 16"; and with a degree of ***accuracy*** that has never been excelled. Their power rapid traverse; multiple cam feeds; direct reading dials; and automatic oiling sell discriminating buyers. Coupled with these mechanical features are convenient controls; simplified adjustments; and means for quick and easy set-up, all of which please the operator.

Cincinnati Shapers are built in regular or universal type from 16" to 36". Ask for Cat. N-3.

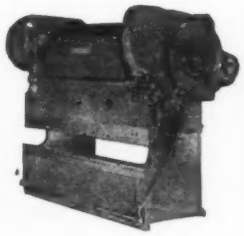
See these machines under power at the Show



Cincinnati Press Brakes, the brakes of many uses, are today's machines for bending, forming, flanging, or multiple punching sheet metal. For easy fabrication, formed parts must fit; therefore ***accuracy*** is a fundamental advantage of these Brakes. Full-rated capacities; all-steel construction; built to withstand overload; deep bed and ram to avoid deflection are a few of the high points. These Brakes are built as accurately as a machine tool, and have unusual mechanical refinements.

Sizes to cover practically any requirement. Ask for Cat. B-2

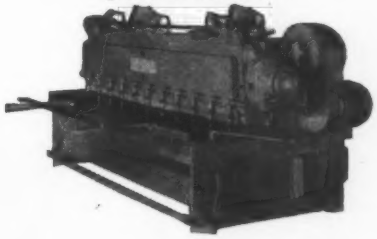
See these machines under power at the Show



Cincinnati All-Steel Shears offer a new degree of ***accuracy*** in shearing sheet metal. They cut to tolerances that take a micrometer to measure; and shear with this ***accuracy*** at high speed. They shear a wide variety of material in both ferrous and non-ferrous metals. Hydraulic holddowns automatically clamp any gauge of metal with the same firm pressure; fine adjustments for the four-edge knives give more efficient use of the keen edge and longer life. Rapid, accurate gauging speeds up handling of the job.

Standard capacities of Shears range from 10 gauge to 1¼ inches. Ask for Cat. S-4.

See these machines under power at the Show



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

See these machines in action at the **Machine Tool Show** Chicago, Sept. 17-26. Booth No. 417

load protection rating of 100 per cent.

The new press is mounted on heavy semi-steel legs, and has a cradle arrangement which permits it to be operated at any desired angle. Gibs, sliding surfaces, and the crankshaft are micro-finished to provide maximum smoothness of operation and long life. All stock parts are interchangeable and require no special fitting in case replacements become necessary. ---------- 85

Hobart Industrial Type Arc-Welders

An exceptionally large illuminated current-indicating scale is an outstanding feature of a new line of industrial type alternating-current transformer welders announced by the Hobart Brothers Co., Box 13, Troy, Ohio. The scale is uniformly calibrated, so that the figures are evenly spaced from minimum to maximum welding heat settings. The translucent plastic dial is illuminated from within by a 110-volt lamp mounted in a standard base, making it easy to read from a distance in either light or dark locations. The light also acts as a tell-tale, indicating that the transformer is energized.

These welders are of the moving coil type, both primary and secondary coils moving when adjustments are made. With this arrangement, less time is required to make welding heat adjustments, and since one coil always moves downward as the other moves upward, the weight of the descending coil counterbalances or helps lift the ascending coil. Adjustment of the current is made by means of a knob on a pressed-steel disk forming the case cover.

A fan at the bottom of the case draws cool air through the louvres at the top and expels it at the bottom. A three-wheeled truck can be bolted to the feet of the unit as shown in the illustration. These welders are available in 300 and 500 ampere sizes for operation on single phase, 60-cycle current of either 220 to 440 volts or 550 volts. They can also be furnished for 50-cycle current if desired. ---------- 86

Federal Bench Type Combination Spot and Projection Welder

The Federal Machine & Welder Co., 18 Dana St., Warren, Ohio, has developed a new general-purpose, air-operated, bench type, combination spot and projection welder for welding mild steel, stainless steel, aluminum, etc. While this machine follows conventional lines, it incorporates several improvements over former models. It is equipped with a special Federal low-inertia rubber head with a micro-switch firing arrangement. The vertically adjustable lower knee is standard, as are the horns and water-cooled ejector type point-holders.

The 30-KVA transformer, contained within the frame, has six steps of heat regulation, which are easily controlled by the tap switch arrangement shown in the illustration. The plug-in type foot-operated switch leaves the operator's hands free to handle the material being welded. This welder is designed as a high-production machine, and lends itself to various applications where ease of operation and sturdy efficient

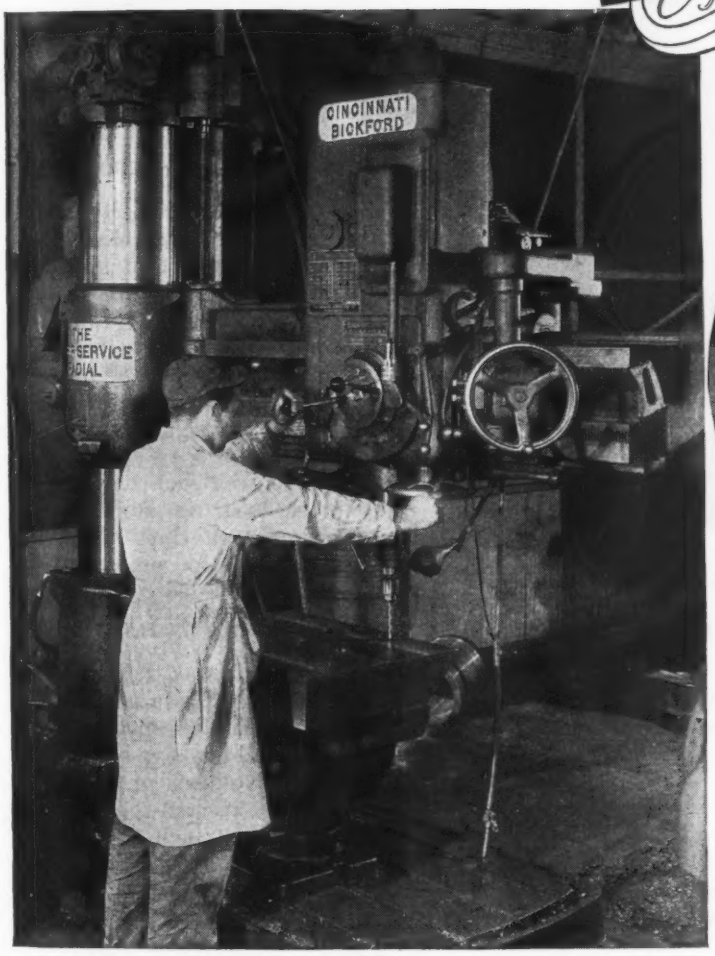
Hobart Alternating-current Arc-welder

Federal Bench Type Spot and Projection Welder

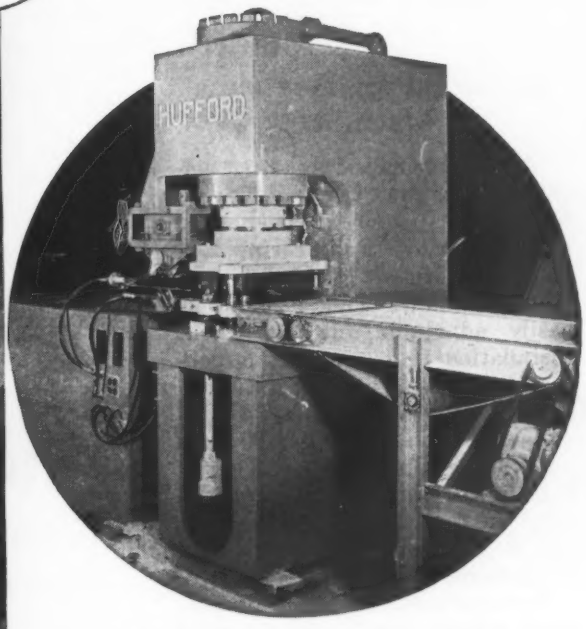
To obtain additional information on equipment described on this page, see lower part of page 202.

2 hours now

4 HOURS BEFORE . . .



Illustrations . . .
Courtesy Hufford Machine Works, Inc.



The 100-Ton Hufford Automatic Hydraulic Tile Press

Drilling, tapping and countersinking operations on a 100-ton press at the Hufford Machine Works, Inc., in one-half the time used before a Bickford Super Service Radial was on the job is a worthwhile saving.

We quote the Hufford Company:

"We needed a versatile drilling tool that would lend itself to a variety of operations. Our employees are enthusiastic over its ease of handling and performance—our management is pleased with its economy of operation, and its precision."

Remember Cincinnati Bickford Super Service Radials are profitable, versatile and dependable in your shop.

Write for Catalog R-24A

See our Condensed Catalog in Sweet's File.

MACHINE TOOL SHOW
DODGE PLANT
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RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

- ***Equal Efficiency of Every Unit Makes the Balanced Machine***

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9. Ohio U.S.A.

design are necessary to lessen operator fatigue.

The 2 1/4-inch stroke of the machine is actuated by an air-operated double-acting cylinder. The throat depth from the machine face to the center line of the electrodes is 6 inches, and from machine face to the center of the platens, 4 1/2 inches. The machine illustrated is furnished with platens having T-slots, which are available if desired. 87

Century Pipe-Threading Machine

A portable pipe-threading machine called the "Century Thread King" has just been announced by the Century Engineering Co., 5529 S. Vermont Ave., Los Angeles 37, Calif. This machine is easily adaptable for permanent installation if desired. It is constructed of a special tough heat-treated aluminum alloy, weighs only 220 pounds, and will ream and thread pipe from 1/2 inch to 2 inches in diameter. Larger size pipe up to 8 inches in diameter can be handled by using a special drive-shaft.

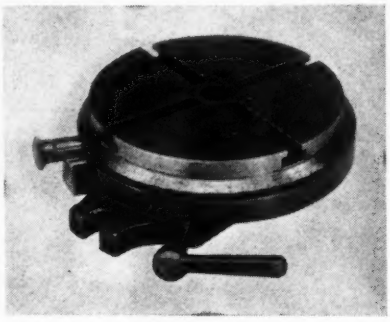
Instantaneous changing of pipe sizes is made possible by a special chuck with a selector dial. One movable clamping jaw with serrated and hardened teeth gives a positive grip on even short pipes.

For reaming, a specially designed reamer is used, which can be quickly lowered into the working position and backed out and raised to clear the work when the operation is completed. A forward movement of the die immediately starts the thread-cutting operation.

The machine is equipped with a wheel and roller cut-off, and with a 1-H.P. motor mounted on a pivoted base to provide the required belt tension. Three-groove step pulleys provide high, medium and low speeds. 88

Work-Table for Engraving Machines and Small Machine Tools

A 5-inch diameter rotary work-table designed for use on engraving machines or on light milling and drilling machines (where it is said to considerably reduce layout time) has been placed on the market by the H. P. Preis Engraving Machine Co., 157 Summit St., Newark 4, N. J.



Preis Rotary Work-table

The outer rim of the table is graduated in degrees and numbered at every tenth degree. Each degree is notched for quick and accurate positioning by engaging the index unit. The working surface is provided with four T-slots for 1/4-inch bolts and a 5/8-inch diameter hole for centering the work with a stud. The height is 1 3/4 inches, and the weight 9 pounds. 89

Van Keuren Improved Microgages

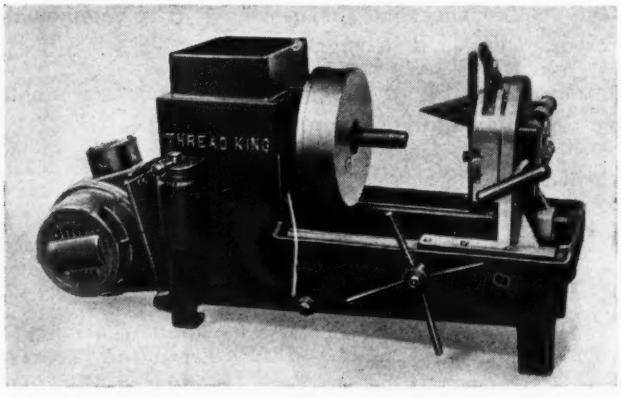
Van Keuren Microgages

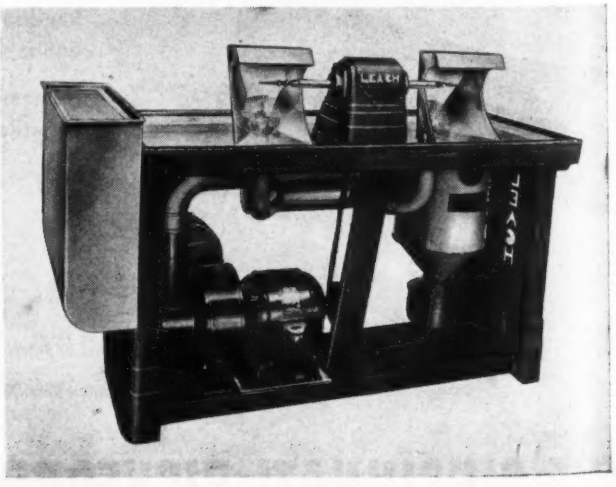
The Van Keuren Co., 176 Waltham St., Watertown, Mass., has announced an important improvement in the line of microgages made by the company. Like the earlier microgages, these improved precision gage-blocks are of round cross-section, but are now 7/8 instead of 11/16 inch in diameter.

The increased diameter of the new gages gives each one 60 per cent more wearing surface and greatly improves their wringing qualities. It also provides the extra rigidity needed in the 2-, 3-, 4-, and 6-inch blocks which enables them to be produced with greater accuracy as regards size and squareness. These new microgages are available in five-, seven-, sixteen-, and thirty-five-block sets. The thirty-five-block set, giving combinations in ten-thousandths inch from 0.300 inch to over 14 inches, is illustrated. 90

Leach Polishing Bench

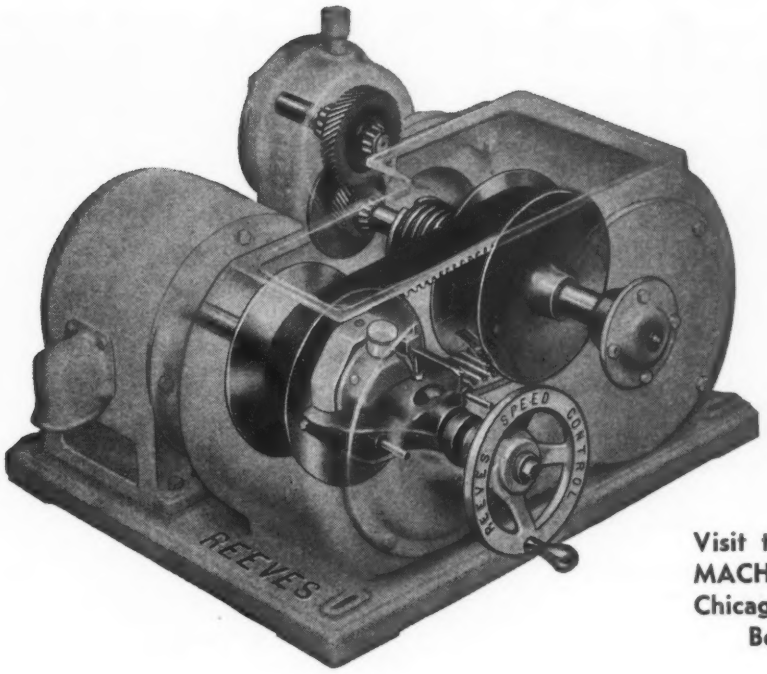
The H. Leach Machinery Co., 387 Charles St., Providence 4, R. I., has developed a self-con-





(Above) Century Portable Pipe-threading Machine
(Right) Leach Self-contained Polishing Bench

To obtain additional information on equipment described on this page, see lower part of page 202.



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MACHINE TOOL SHOW
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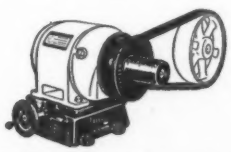
260,000 Testimonials Tell the REEVES Story

These testimonials aren't letters—but machines! They are doing the intricate jobs, the strange jobs and the familiar jobs on production lines in scores of industries, your own included. They are handling materials of widely varying consistency, weight, hardness and temperature . . . steel, textiles, rubber, foods, plastics, glass, pharmaceuticals and many others. They are stamping, grinding, shaping, turning, winding, spreading, cooling, buffing, conveying and so on . . . some under the direction of skilled, experienced operators and others in the hands of awkward newcomers. But this they have in common: *all* 260,000 of these machines are equipped with REEVES Speed Control . . . *all* are performing each and every operation at exactly the right speed to get the best from man, material and machine . . . *all* are proving, through their day-after-day performance, that REEVES holds the key to improved production—cost-wise and quality-wise!

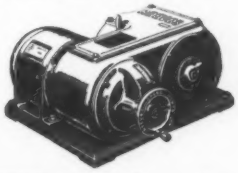
REEVES PULLEY COMPANY • COLUMBUS, INDIANA
Recognized Leader in the Specialized Field of Speed Control Engineering

THE THREE BASIC REEVES SPEED CONTROL UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

Accurate Variable
REEVES Speed Control
Gives the Right Speed for Every Job!

tained polishing bench for cutting, buffing, and polishing plastic and metal parts. The bench is equipped with a ball-bearing, two-spindle polishing head that accommodates various types of spindles, including taper spindles. This double-spindle head is arranged for two-speed operation, and is directly connected to a 2-H.P. motor. In addition a dust collecting system is built into the bench to insure protection to the workers and eliminate the need for a water spray.

This polishing bench is applicable in the jewelry, plastics, electrical, and other industries. 91

Benjamin Automatic Double-End Shaft-Turning and Centering Machines

Two new Benjamin automatic machines designed to cut in half the time required for machining electric motor shafts and similar work have just been announced by the Stanford-Roberts Mfg. Co., 619 E. Iron Ave., Dover, Ohio. The machine seen in Fig. 1 is completely automatic in operation. It will machine both ends of a shaft simultaneously, thus eliminating handling time.

An all-carbide tool set-up employing maximum speeds and feeds and automatic chucking of the work with center-drive equipment make possible accurate work at high production rates. An automatic handling attachment is also available for this machine. The machine will perform all turning, beveling, and under-cutting operations in one handling or chucking of the work.

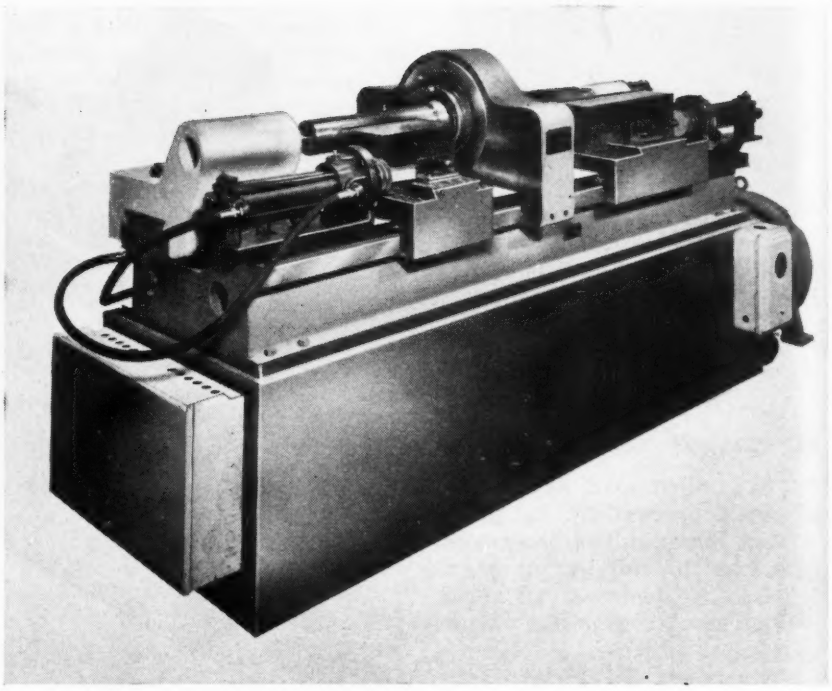


Fig. 1. Benjamin Automatic Double-end Shaft-turning Machine

Provision is made for stepless adjustment of the hydraulic feed. A three-point support is provided for the shaft to be machined, which consists of a heavy-duty live center at each end and an automatic center drive at the core diameter. The retracting tailstock simplifies loading and unloading. The center-drive unit is mounted on heavy-duty Timken bearings. The machine will handle work from 1/2 inch to 4 3/4 inches in diameter and up to 60 inches in length, with a dead center space of 7 inches.

The new Benjamin centering automatic, shown in Fig. 2, is designed to obtain greater accuracy and reduce set-up time to a minimum. Concentricity of shaft center-holes is said to be assured by the revolving work-piece. The chucking and machining are fully automatic and permit facing, centering, drilling, turning, and threading both ends of the shaft simultaneously. It can also be used for boring and beveling tubing. Fixtures can be attached to each end of the center-drive chuck for holding work other than shafts or tubing, so that two pieces can be machined at a time. The machine has a capacity for handling work 1/8 inch to 1 1/2 inches in diameter and from 5 to 30 inches in length. 92

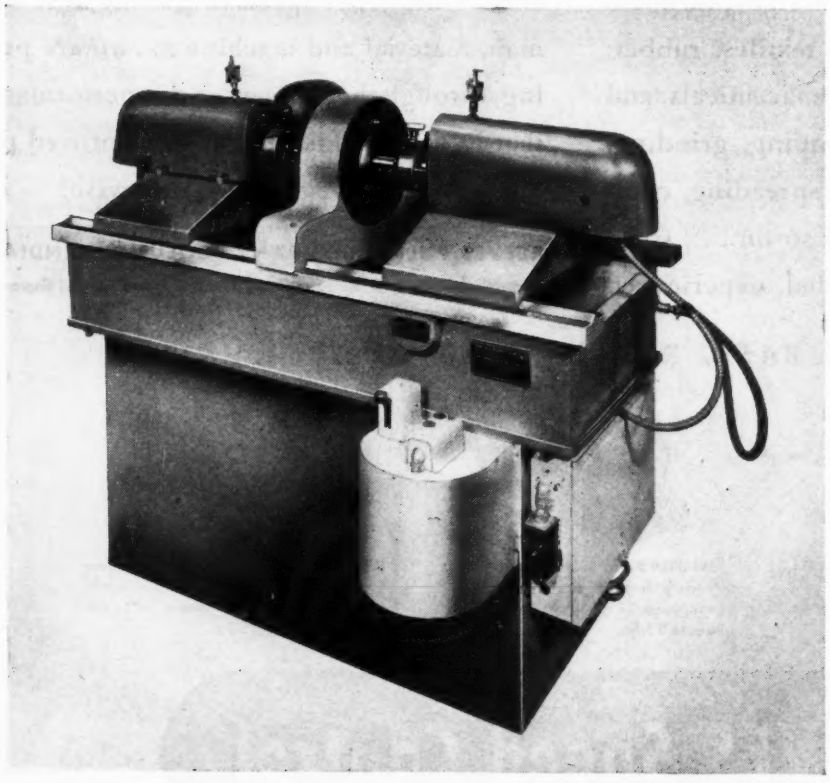


Fig. 2. Benjamin Automatic Centering Machine

To obtain additional information on equipment described on this page, see lower part of page 202.

EX-CELL-O says

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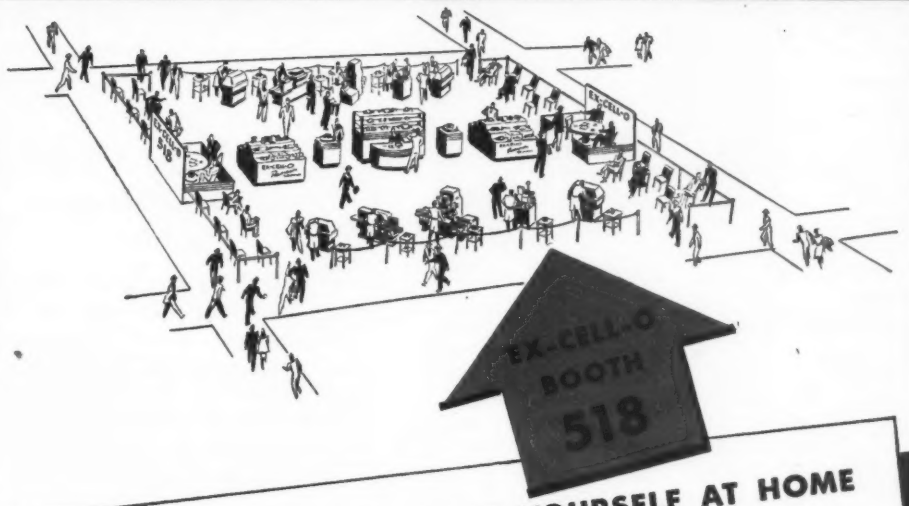
NEW

and IMPROVED

MACHINE TOOLS



YOU ARE INVITED TO MAKE YOURSELF AT HOME AT THE BIG EX-CELL-O EXHIBIT *Featuring . . .*

. . . new and improved Ex-Cell-O precision machine tools—with definite advancements in automatic cycling, greater output, increased versatility, and labor-saving characteristics—all designed to aid manufacturers in reducing their production costs. Be sure to visit the Ex-Cell-O Exhibit at the Machine Tool Show at the DODGE-CHICAGO PLANT, September 17 to 26 (Booth 518). You'll be made welcome there!

47—28

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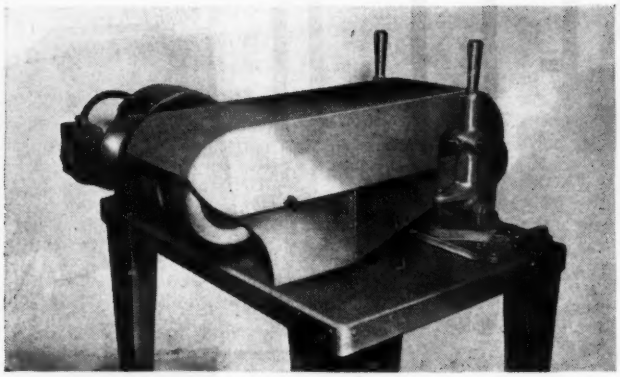
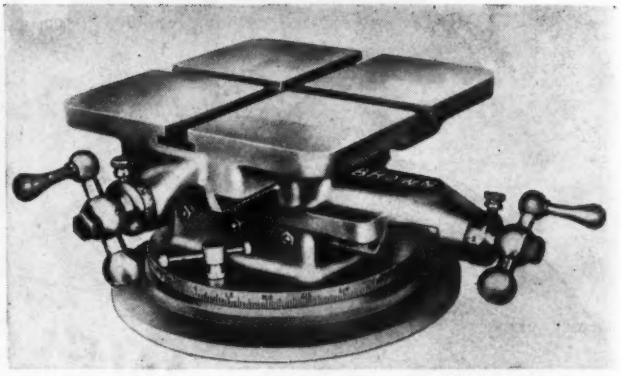


Porter-Cable Double-belt Bench Grinder



Brown Rotary-base Two-way Sliding Table

Bench Grinder with Two Abrasive Belts

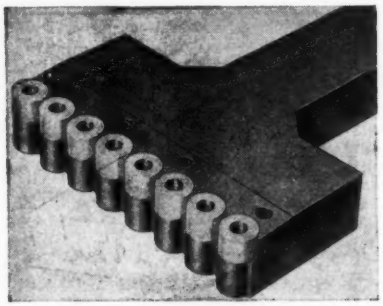
The Porter-Cable Machine Co., 1801-7 N. Salina St., Syracuse 8, N. Y., has added a double-belt bench grinder to its line of precision abrasive-belt grinders. The new machine has a heavy-duty shaft on which two 7-inch diameter by 2 1/2-inch wide resilient contact rolls are mounted, side by side. Each contact roll is aligned with an idler roll, which is adjustable for abrasive belt tension, tracking, and alignment with the contact roll. This set-up provides for the use of two endless metal-cutting abrasive belts, 2 1/2 inches wide by 60 inches in circumference. The result is a two-station grinder having one station fitted with a coarse abrasive belt for rough-grinding, while the other has a fine grit belt for finishing.

The grinder is equipped with a 1-H.P. motor, which drives the abrasive belt at a cutting speed of 5200 surface feet per minute.....93

Kennametal Roughing Roll-Turner for Chilled Cast-Iron Rolls

A new rough-turning tool designed to speed up redressing operations on chilled cast-iron rolls has been developed by Kennametal Inc., Latrobe, Pa. This tool comprises a series of replaceable sharp-edged solid Kennametal cemented-carbide disks, secured to a heat-treated shank by countersunk cap-screws and backed up by a hardened steel plate. The first cut taken with this tool turns a series of circular grooves having rough humps between them. The tool is then repositioned and a second cut taken, which removes the humps, leaving a "scalloped" surface which is smoothed out with a Kennametal finishing tool of the block type described in December, 1946, MACHINERY.

The advantages claimed for this new tool include easier cutting through scale; faster roll-



Kennametal Rough-turning Tool for Use on Chilled Cast-iron Rolls

turning speeds; more metal removed per cut; quicker turning or machining of the roll; and less stock left for removal by the finishing tool.

When the cutting disks become dull, they can be rotated to a new cutting position. Several cuts can be made before the disks need to be resharpened, an operation which is easily accomplished by simply smoothing up the tops of the disks. A disk that has been accidentally damaged can be quickly replaced with a new one. This tool is available in 4-, 6-, 8-, and 10-inch widths. 94

Brown Rotary-Base Two-Way Sliding Table

A rotary-base two-way sliding table with the base graduated to 360 degrees has just been announced by the Leo G. Brown Engineering Co., 1127 Riverside Drive, Los Angeles 31, Calif. The 7 1/2- by 7 1/2-inch table is mounted on two slide ways equipped with adjusting screws, which have a travel of 6 inches and are set at 90 degrees to each other. Two clamping screws in the base serve to lock the table securely at any desired angular position. The over-all height of this table is 4 1/4 inches, and the weight 35 pounds. 95

Cabinet Type Variable-Speed Flexible-Shaft Machine

A new variable-speed flexible-shaft machine known as the "Wycomatic" speed-changer has been announced by Wyzenbeek & Staff, Inc., 838 W. Hubbard St., Chicago 22, Ill. This machine has been designed to give the operator complete control of the shaft

"Wycomatic" Speed-changer Flexible-shaft Machine

To obtain additional information on equipment described on this page, see lower part of page 202.

5 Big Headlines in the N

Chicago Show News

A NEW LINE OF AUTOMATIC SCREW MACHINES

Six high speed spindles and a capacity of up to 2¼" on steel, aluminum or brass. Weight, power and speed to handle carbides. Radial tooling — a new, proved principle giving the same line of forming thrust in every position, five heavy duty forming slides, and full chip capacity.

Time for cam changes eliminated for all practical purposes. No change in cams necessary for a change in feed-out length. No change in cams necessary for the main tool slide. A universal tool slide cam produces any ratio of approach to feed. Interchangeable cross slide cams directly behind slides eliminating deflection — easily, quickly changed. Auxiliary camming in any two positions among 4, 5 and 6. A change in set-up does not require a change in stops, high point, drawback point, total stroke, or a sacrifice of working time on all cross slides and main tool slide.

A fast, powerful machine which will outperform anything modern tools will handle and anticipates future tool developments.

Chicago Show News

A NEW LINE OF AUTOMATIC TURRET LATHES

Bridges the gap between the lathe and the automatic. Bui in three sizes to handle bars or tubes up to 8". High spind speeds. Carbide tooling. Quick, easy set-up and change-over. C be economically set up for ten or ten thousand pieces. Function of main turret and cross slides are independent. Turret will re ciprocate, index and perform its operations while cross slide continue to form or cut-off.

No cam change necessary on main turret. Infinite variation in feed per revolution available merely by turning a dial. This a strong, positive mechanism. High point, drawback, total stroke and stops remain the same. Extra heavy cross slides of new desig have cams directly behind slides, eliminating deflection. Remov three screws and cover and cams come off.

New air feed device eliminates stock pushers. Bar is supporte at both ends between collet and a revolving tail stock. Therefore variations in stock will not affect it. One man can easily run it This air feed automatically positions the stock, feeds it throug the spindle, and grips it ready for turning.

Chicago Show News

A NEW LINE OF CONTOUR BORING & TURNING MACHINES

These new precision machines are accurate an fast, cam and air actuated. It is possible to singl point turn or bore contours, radii, steps, angles faces or any desired shape. Cam control guarantee these advantages: 1. Constant quality of wor unaffected by temperature fluctuations 2. Unvarying accuracy — only one dimension o single tool contour need be inspected. 3. Saving o production time by jumping tools close to startin point and across portions not machined.

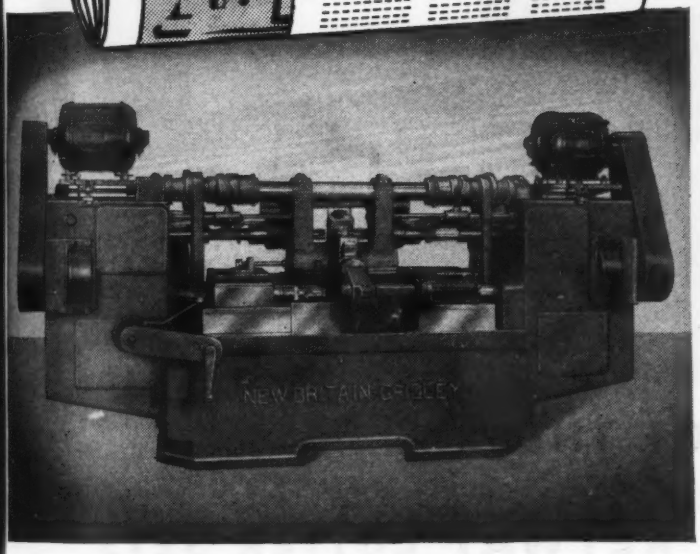
The tool may cut either on feed-in or drawback It is relieved and returns clear of work on rapi traverse, to eliminate drag-off marks on eith turning or boring.

These machines can be equipped with two more constant temperature, anti-friction mounte precision spindles, and all types of spec chucking fixtures. Spindle speeds to 7,500 R.P.

eNews from Chicago...

Chicago Show News

A NEW DOUBLE END CHUCKING MACHINE

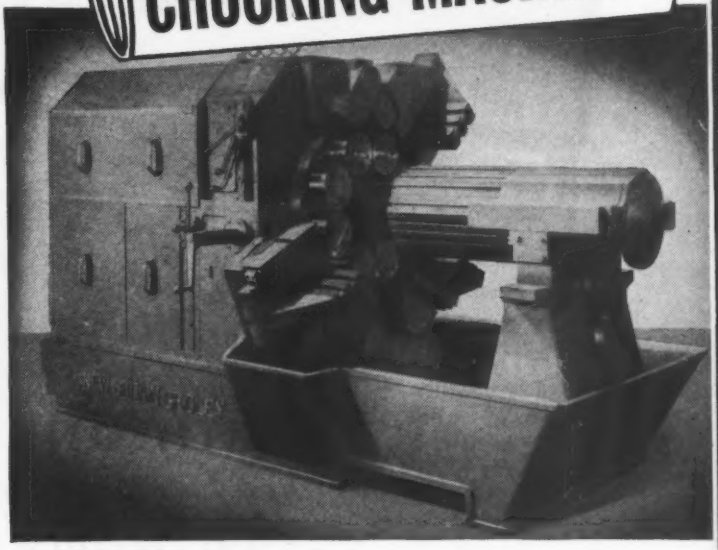


The new Model 365 Double End Tool Rotating Chucking Machine is essentially a powerful, high production, modern tool. Fully automatic, it features power chucking and unchucking, precision alignment of opposing spindles, accurate threading, quick indexing, rapid traverse on all idle motions, and fully interlocked safety controls.

This new model has a central indexing work holding fixture with three work spindles on each side. Two opposite ends of the same piece can be rough and finish bored, faced, chamfered, reamed, and threaded simultaneously with a corresponding saving in time and also the assurance of alignment between the two machined ends. In some cases, this machine produces two similar pieces at the same time, one on each side of the chuck. Speeds up to 2,000 R.P.M. have been provided making the machine very suitable for machining non-ferrous metals. In addition, it has all the necessary rigidity for the full use of carbide tooling.

Chicago Show News

A COMPLETE LINE OF AUTOMATIC CHUCKING MACHINES



These chuckers are built in 4, 6, or 8 spindle models with many variations in chuck sizes. Model 98 shown above. They feature open end construction, providing wide open accessibility to all tools and convenient removal of chips. Both swinging forming arms and flat cross slides are available. Forming in 5 out of 6, or 6 out of 8 spindles. Six and eight spindle models can be arranged for double index for finishing two pieces per cycle or machining both ends of a piece.

Automatic spindle carrier clamping device eliminates carrier weave during cutting cycle. Hydraulic operation for chucking mechanism and positive drive syncro-mesh spindle clutches through exclusive New Britain system affording rapid action. Variable chucking pressures instantly adjustable and operating automatically to reduce pressure in finishing positions. A multiple power unit and drill speeders furnish independent speeds for turret tools.

IN THE MIDST OF EVERYTHING AT THE SHOW

Practically at the center of the floor you will find NEW BRITAIN MACHINE, one of the largest exhibits — one of the most important if you are going to Chicago to see really *new* machine tool developments — really *basic* in cutting metals to cut costs. Our booth is No. 311. We will show all five models appearing in this advertisement plus other new and interesting engineering features and machines. We'll be seeing you September 17.

THE NEW BRITAIN MACHINE CO.

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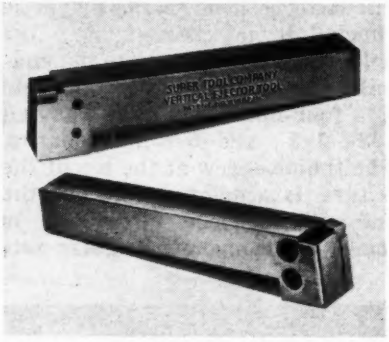
Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

tings, by means of which each cutting edge is ground down to the center of the end-mill. The required clearance is also ground back of the cutting edge. The latch at the front of the fixture can be engaged in any one of four slots, spaced 90 degrees apart, to provide for indexing the work for grinding the cutting edges of end-mills having four flutes. 99

Vertical Ejector Type Tool with Square Carbide Insert

Six new holders with square carbide inserts have been added to the line of ejector type tools manufactured by the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. The new vertical tool presents one side of the square insert to the cut. By first rotating and then inverting the insert, a total of eight cutting edges, four on each end, can be used before re-



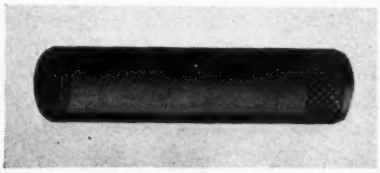
Ejector Type Holder with Square Carbide Insert, Made by the Super Tool Co.

sharpening of the insert is necessary. The 3/8-inch square insert supplied for all holders can cut to a depth slightly under 3/8 inch.

In addition to its application for both roughing and finishing, it can also be used for facing and for turning to a shoulder. Horsepower requirements are the same as for standard turning tools..100

Self-Sizing Dowel-Pin

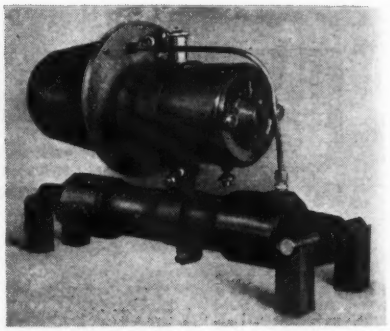
Partially knurled dowel-pins that do not jam or stick when being driven into a hole have been



Baumbach Dowel-pin Knurled at One End to Prevent Jamming

introduced on the market by the E. A. Baumbach Mfg. Co., 1812 S. Kilbourn Ave., Chicago 23, Ill. These dowel-pins, with one end knurled as shown in the illustration, are hardened and ground to 0.001 inch over size. The knurled and ground end acts as a broach when the pin is driven in, sizing the hole and removing irregularities left by drilling or reaming.

Also, since the pins are ground 0.001 inch over size, they can be used in holes from 0.002 inch under size to 0.001 inch over size with the assurance that a tight fit will be obtained. 101



Hydraulic Pumping Unit Developed by John Dusenbery Co.

Hydraulic Pumping Unit

Although developed primarily for actuating rams on automotive and tractor equipment, the new hydraulic pumping unit brought out by the John Dusenbery Co., 150 Pine St., Montclair, N. J., is adapted for various industrial applications. It consists of a reservoir-enclosed hydraulic pump having a capacity of 1000 pounds per square inch, a check valve, a release valve, and an adjustable relief valve. The unit can be equipped with a 115-volt alternating-current driving motor. It can be operated in either a horizontal or vertical position.

The size of the pump is 14 inches long by 7 1/2 inches in diameter without the mounting brackets. If required, the unit can be equipped with an externally mounted, four-way valve for double-acting cylinders. In operation, a ram force of 2500 pounds is exerted at the rate of 1 inch per second. 102

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in August, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....**POSITION OR TITLE**.....

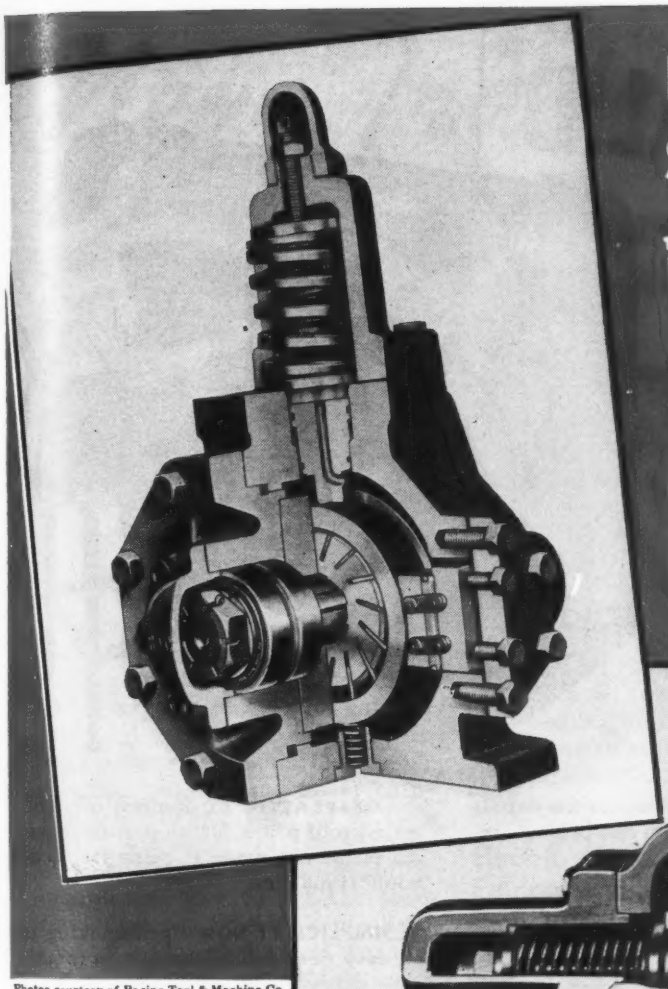
[This service is for those in charge of shop and engineering work in manufacturing plants.]

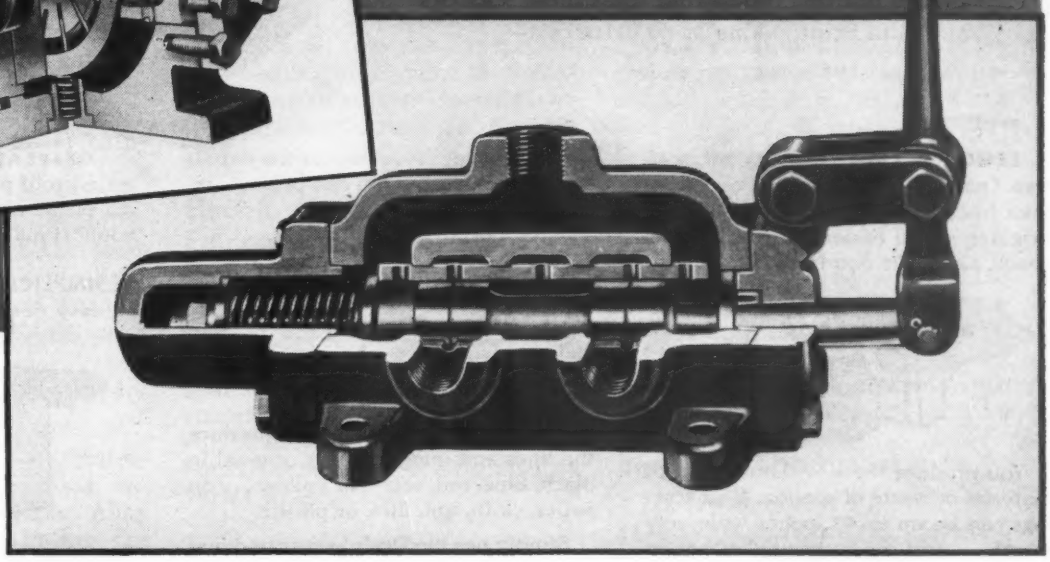
FIRM.....

BUSINESS ADDRESS.....

CITY.....**STATE**.....

Keep Hydraulic Systems Free From RUST and SLUDGE





Photos courtesy of Racine Tool & Machine Co.

RUST AND SLUDGE are major causes of stoppages in hydraulic mechanisms. You can prevent both by using *Texaco Regal Oils* (*R & O*)—turbine-grade oils specially inhibited against rust and oxidation, and processed to prevent foaming. They'll assure you smoother, more dependable operation and lower maintenance costs.

One user, for example, reports that *Regal Oils* (*R & O*) have doubled the time between oil replacements and eliminated earlier troubles with oil varnish deposits. Another user has had *Regal Oils* (*R & O*) in service for over a year without a single shutdown due to failure of hydraulic units.

These reports on the outstanding performance of *Texaco Regal Oils* (*R & O*) are echoed everywhere. Leading hydraulic equipment manufacturers recommend *Texaco Regal Oils* (*R & O*) and many ship their units filled with them.

You can get *Regal Oils* (*R & O*) in viscosities for every type and size of hydraulic mechanism. For full information, call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

Tune in...TEXACO STAR THEATRE presents the NEW TONY MARTIN SHOW every Sunday night. See newspaper for time and station.

NEW! THE OZALID STREAMLINER

- Reproduces your engineering and architectural drawings in seconds—also your typed, printed, photographic material.
- Moderately priced . . . designed for the thousands of drafting rooms that want these 5 EXTRA VALUES in Printmaking at no extra cost—

1. EFFICIENCY! You always get positive (not negative) prints direct from your tracings . . . prints that are sharper, brighter, much easier for you to read, check, and make notations on.

You produce these without waste of material or waste of motion. Your tracings can be up to 42 inches wide, any length . . . and can be printed either on rolls of Ozalid sensitized paper or on cut sheets of matching size.

Your prints are always delivered dry, ready for immediate use . . . after just two simple operations—Exposure and Dry Development.

2. SPEED! ONLY 25 seconds to reproduce your standard-size tracings, specification and data sheets, etc.

3. ECONOMY! An 8½ x 11-inch reproduction costs you *one cent;* 11 x 17 inches, two cents . . . and so on. The Ozalid Streamliner soon pays for itself . . . in time, labor, and dollars saved.

With it, you can also effect amazing short cuts in design. For example—eliminate redrafting when changing obsolete drawings . . . combine the details of separate tracings on *one* print . . . re-

claim old or worn tracings . . . make transparent overlays in different colors.

4. VERSATILITY! You can reproduce the lines and images of any original in black, blue, red, sepia, or yellow . . . on paper, cloth, foil, film, or plastic.

Simply use the Ozalid sensitized material you think best for job at hand; e.g., use identifying colors for prints of separate departments or operations . . . DRYPHOTO to produce beautiful con-

tinuous-tone prints from film positives (which can be made from any negative) . . . OZAPLASTIC to produce oilproof, waterproof prints for shop or field use. *All* prints are made in same fast, economical manner.

5. SIMPLICITY! NOW—printmaking is an easy desk job, automatic in practically every detail.

Anyone can feed originals and sensitized material into the Ozalid Streamliner. Prints are delivered on top, stacked in order—within easy reach of the operator, who does not have to leave her chair.

You can install your Streamliner anywhere; it requires only 11 square feet of floor space.

Write today for free, illustrated booklet . . . showing all the ways you can use the new OZALID STREAMLINER . . . and containing actual reproductions—like those you can make.

Gentlemen: Dept. 300

Please send New Ozalid Streamliner booklet . . . containing reproductions of drawn, typed, printed, and photographic material. No obligation.

Name_____

Position_____

Company_____

Address_____

OZALID

DIVISION OF
GENERAL ANILINE AND FILM CORPORATION
Johnson City, New York

Ozalid in Canada
Hughes Owens Co., Ltd., Montreal

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 206 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the August, 1947, Number of MACHINERY

Grinding Carbide Tools

NORTON CO., Worcester 6, Mass. Handbook containing complete data on methods of reconditioning and sharpening cemented-carbide tools and cutters. The data covers wheels for grinding carbide tools; grinding single-point tools; chip-breakers; hand-honing of carbide tools; grinding of multi-tooth cutters; miscellaneous grinding operations; how to get the most from diamond wheels; centralized control and grinding of carbide tools; and wheel speed table. 1

Copper and Copper Alloys Specifications Index

AMERICAN BRASS CO., Waterbury 88, Conn. Booklet B-34, entitled "Copper and Copper Alloy Specifications Index," listing the company's most generally used alloys, together with standard specifications. Also included is a list of the various standard specifications in numerical order, with a brief description of the grade, type, temper, anneal, etc., of the material. 2

Tool Engineering Service

BUNELL MACHINE & TOOL CO., 1601 E. 23rd St., Cleveland 14, Ohio. Bulletins entitled "Men Who Make Bunell"; "Men, Machines and Experience"; and "Bunell is the Name . . . " containing information on the personnel and facilities of the company for designing and manufacturing tools, dies, gages, and special machines. 3

Involute Spline Cutting Tools

ILLINOIS TOOL WORKS, 2501 N. Keeler Ave., Chicago 39, Ill. Booklet containing tooling recommendations for the production of standard involute splines, including data on the proper hobs, shaper cutters, and broaches for producing each type of spline to dimensions and tolerances specified by the American Standard B 5.15-1946. 4

Electric Power and Industrial Equipment

ALLIS-CHALMERS MFG. CO., Box 512, Milwaukee 1, Wis. Annual Review, outlining the engineering progress achieved during the past year by the company in producing electric power and industrial equipment. A brief section is devoted to each of the company's varied lines. 5

Handbook on Nickel and Nickel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York 5, N. Y. Condensed handbook and guide on nickel and high-nickel alloys, including data on properties, heat and corrosion resistance, as well as fabrication and finishing practices. 6

Contour Boring and Turning Machine

NEW BRITAIN MACHINE CO., New Britain, Conn. Circular 682, describing the construction and operation of the New Britain precision contour boring and turning machine; includes complete specifications. 7

Torsion Testing Machines

TINIUS OLSEN TESTING MACHINE CO., 598-A N. Twelfth St., Philadelphia 23, Pa. Bulletin 34, describing the company's complete line of torsion testing machines in capacities from 100 to 2,000,000 inch-pounds. Data is included on wire twisting equipment. 8

Lubricating Oils and Greases

FREEDOM-VALVOLINE OIL CO., Department 241, Freedom, Pa. Pamphlet entitled "Buy on Performance," prepared by the Lubrication Committee of the American Petroleum Institute, discussing the practice of buying by specification, as compared with buying by brand name. 9

Bar-Feed Attachment

HY-LEVEL SCREW PRODUCTS CO., 2114 W. Superior Ave., Cleveland 13, Ohio. Folder describing an attachment applicable to most single-spindle automatic screw machines for automatically feeding bar stock by means of the coolant and coolant pump on the machine. 10

Care and Use of Punches and Dies

ALLIED PRODUCTS CORPORATION, RICHARD BROTHERS DIVISION, 4640 Lawton Ave., Detroit 8, Mich. Booklet entitled "Punch Pointers," containing instructions for the proper care and use of the interchangeable punches and dies made by this company. 11

Hydraulic Die Duplicating Machine

TURCHAN FOLLOWER MACHINE CO., 8259 Livernois, Detroit 4, Mich. Catalogue descriptive of

the operation of the Turchan hydraulic follower machine designed for duplicating dies, molds, patterns, etc. 12

Electronic Automatic Welding Machines

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo 11, N. Y. Catalogue illustrating and describing the Niagara electronic automatic welding machine. 13

Flux-Injection Cutting

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Pamphlet containing an article entitled "Flux-Injection Cutting of Stainless Steels," covering the fundamentals, capacities, and advantages of this new process. 14

Sine-Line Lead Checker

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit 12, Mich. Technical bulletin describing the principle of operation of the company's Model 1204 sine-line lead checker having a lead range from 6 inches to infinity. 15

Hydraulic Feed Units

AVEY DRILLING MACHINE CO., Cincinnati, Ohio. Bulletin 547, describing the construction and operation of "Avey-draulic" feed units for drilling operations, adapted for vertical, horizontal, or angular application. 16

Steel Plate Shapes

BY-PRODUCTS STEEL CORPORATION, DIVISION LUKENS STEEL CO., 181 Strode Ave., Coatesville, Pa. Catalogue showing typical examples of steel plate shapes supplied by the company for a variety of uses. 17

Automatic Heat-Treating Units

IPSEN INDUSTRIES, INC., 311 Blackhawk Bldg., Rockford, Ill. Circular illustrating and describing the Ipsen automatic heat-treating unit, with batch-loading furnace and automatic unloading quench tank. 18

Machinery Drives

AMERICAN PULLEY CO., Philadelphia 29, Pa. Bulletin on Speed-Jack drives, giving maximum and minimum speeds for machinery drives operating up to 1 H.P. and data enabling the user to select the proper size of sheave for the desired speed range. 19

Welding Tin Bronzes and Brass

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Welding procedure sheets, telling how to weld tin bronzes and brass, and describing the use of Ampco bronze welding electrodes on these alloys. 20

Resistance Welders

WELDEX, INC., Department K, 7308 MacDonald Ave., Detroit 10, Mich. Catalogue describing the company's complete line of bench and floor model resistance welding machines, ranging from 1 to 7 1/2 K.V.A. 21

Assembly Presses

COLONIAL BROACH CO., Box 37, Harper Station, Detroit 13, Mich. Bulletin PA-47, showing the company's expanded line of hydraulically operated assembly presses comprising models from 10 to 50 tons capacity. 22

Broaches

CONNECTICUT BROACH & MACHINE CO., New London, Conn. Catalogue entitled "Better Broach It," containing ten case histories of actual broaching operations performed in manufacturing plants. 23

Air-Operated Bench Vises

VAN PRODUCTS CO., Erie, Pa. Catalogue illustrating and describing the "Vi-Speed" an air-powered bench vise with foot control. Catalogue illustrating various applications of this equipment in actual practice. 24

Permanent Magnetic Separators

HOMER MFG. CO., INC., I-35, Lima, Ohio. Bulletin showing several different styles of permanent magnetic separators and pulleys for removing tramp iron and steel in processing. 25

Tube-Making Machine

AMERICAN ELECTRIC FUSION CORPORATION, 2600 W. Diversey Ave., Chicago 47, Ill. Catalogue describing this company's tube mill, designed for converting strip steel into electrically welded tubing. 26

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (August, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME..... POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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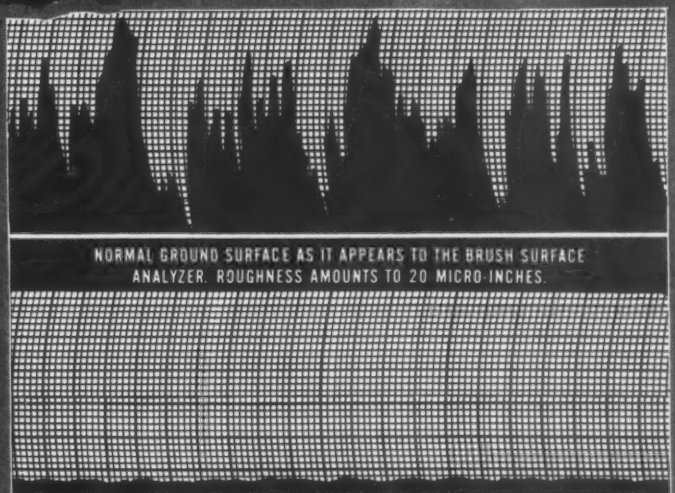
like skating on cinders!

How long could rollers stand this? Not long . . . yet bearings must stand this same kind of punishment with a typical "finished" surface.

There it is, at the right, an actual profile of a normal ground surface as shown by the Brush Surface Analyzer. Look at those ups and downs, and you'll see why bearings wear out before their time.

Now look below at the Brush analysis of a *Superfinished* surface. Smooth? Yes, *seven times as smooth* as the usual ground surface! No grinder scratches, no feed spirals, no chatter marks, no fragmented metal.

Without such defects to rupture the protective film of oil, the life of a bearing has no limit. So it pays to know about Superfinishing . . . and Gisholt engineers are ready with the facts.

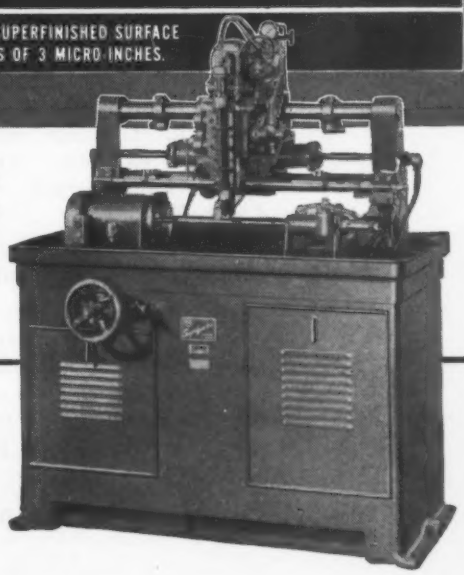


NORMAL GROUND SURFACE AS IT APPEARS TO THE BRUSH SURFACE ANALYZER. ROUGHNESS AMOUNTS TO 20 MICRO-INCHES.

BRUSH ANALYSIS OF A SUPERFINISHED SURFACE SHOWS A SMOOTHNESS OF 3 MICRO-INCHES.

GISHOLT MACHINE COMPANY

1245 E. Washington Ave. • Madison 3, Wisconsin



THE GENERAL PURPOSE SUPERFINISHER is a self-contained unit, simple to operate. Handles a wide variety of miscellaneous or production work. Also available — — specialized machines for all requirements.

THE GISHOLT ROUND TABLE
represents the collective experience of leading specialists in the machining, surface finishing, and balancing of round or semi-round parts. Your problems are welcomed here.

Non-Ferrous Products

DOWNS-SMITH BRASS & COPPER CO., 310 E. 45th St., New York 17, N. Y. Catalogue listing 500 different brass and copper products, and giving data on tolerances, weights, physical properties, etc. 27

Carbon-Steel Wrenches

J. H. WILLIAMS & Co., 400 Vulcan St., Buffalo 7, N. Y. Circular containing complete data, including list prices, on the Williams line of carbon-steel wrenches, made in a wide range of sizes. 28

Vibration-Isolation Mounting

LORD MFG. CO., Erie, Pa. Bulletin 106, describing a new "Multiplane" bonded-rubber mounting designed to provide isolation from vibration, regardless of the direction of disturbing forces. 29

Air Gages

FEDERAL PRODUCTS CORPORATION, 1144 Eddy St., Providence 1, R. I. Bulletin describing the construction and application of the Federal Metricator dimensional air gage. 30

Industrial Cleaning Unit

OAKITE PRODUCTS, INC., 126 Thames St., New York 6, N. Y. Booklet describing the new Oakite-vapor steam cleaning unit, of improved construction, for industrial use. 31

Special Industrial Machinery

LAKE ERIE ENGINEERING CORPORATION, 170 Woodward Ave., Buffalo 17, N. Y. Bulletin describing the company's facilities for designing and manufacturing special industrial machinery. 32

Heat-Treating Cylinder Liners

AJAX ELECTRIC CO., INC., Frankford Ave., at Delaware Ave., Philadelphia 23, Pa. Circular containing an article entitled, "Austempered Cast Iron Serves As Cylinder Liners." 33

Material-Handling Equipment

REVOLVATOR CO., North Bergen, N. J. Catalogue illustrating the various types of portable and stationary elevators, lift-trucks, and other material-handling equipment made by the company. 34

Trimming Presses

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa. Bulletin 3-L-7, illustrating and describing Chambersburg steel-side trimming presses for forge shops and other uses. 35

Scratch Recording Strain Gage

BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa. Bulletin 265, illustrating and describing the deForest scratch recording strain gage, a small low-cost gage. 36

Ball Bearings and Rollers

OMEGA BALL BEARING CO. INC., 187 Cottage St., Poughkeepsie, N. Y. Catalogue giving dimensions, load capacities, and list prices for unground ball bearings and ball-bearing rollers. 37

Pliers and Wrenches

PLOMB TOOL CO., 2209B Santa Fe Ave., Los Angeles 54, Calif. Bulletin 4728, descriptive of the complete line of pliers, adjustable wrenches, and pipe wrenches made by the company. 38

Air-Controlled Equipment

BELLOWS CO., Akron, Ohio. Series of "Foto Facts" circulars, containing production data for various jobs performed on machines equipped with Bellows "controlled air" power feeds. 39

Tube-Fabricating Equipment

PARKER APPLIANCE CO., 17325 Euclid Ave., Cleveland 12, Ohio. Catalogue 401, descriptive of Parker production tube benders and accessories. 40

Hydraulic Presses

PRECO, INC., 960 E. 61st St., Los Angeles 1, Calif. Circular illustrating and describing the Preco 40,000 pound two-stage hydraulic press. 41

Scrap Cutter

HALLER MACHINE & MFG. CO., INC., 7940 Tireman Ave., Detroit 4, Mich. Illustrated leaflet describing the Haller scrap cutter for use on punch presses. 42

Fluid Pump

AMERICAN METAL PRODUCTS CO., Fort Worth 9, Tex. Folder descriptive of a new type of stainless-steel fluid pump applicable to machine tools. 43

Permanent Magnets

GENERAL ELECTRIC CO., Chemical Department, Pittsfield, Mass. Booklet on permanent magnets, covering characteristics, design, properties, and applications. 44

Carboloy-Tipped Face Mills

LOVEJOY TOOL CO., INC., Springfield, Vt. Catalogue giving specifications on "Cutsall" Carboloy-tipped tool bit type face mills, including grinding instructions. 45

Abrasive Wheel Handbook

CHARLES H. BESLY & CO., 118-124 N. Clinton St., Chicago 6, Ill. Pocket-size, 48-page handbook containing complete data on Besly-Titan abrasive wheels. 46

Position-Indicating Equipment

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GET-1304, containing application data on direct-current selsyn remote-indicating instruments. 47

Couplings and Caps

ROYLYN, INC., 718 W. Wilson Ave., Glendale 3, Calif. Catalogue containing engineering data and specifications on couplings, caps, and allied products. 48

Flexible-Shaft Machinery

WYZENBEEK & STAFF, INC., 838 W. Hubbard St., Chicago 22, Ill. Catalogue showing the company's complete line of flexible-shaft equipment. 49

X-Ray Control

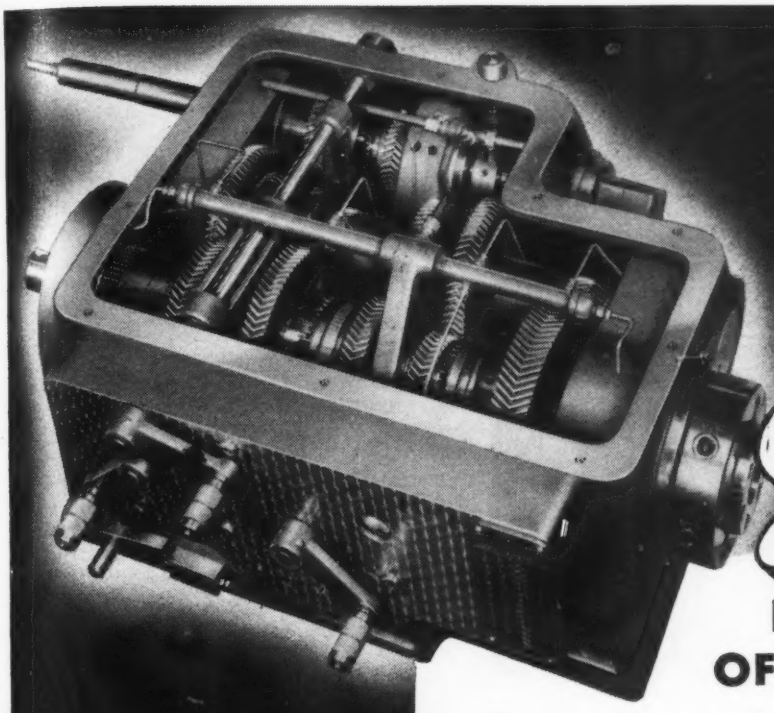
NORTH AMERICAN PHILIPS CO., INC., 100 E. 42nd St., New York 17, N. Y. Folder R1063, entitled "Industrial Control with X-Ray Diffraction." 50

Nickel Steel and Brass Coils

AMERICAN NICKELOID CO., Peru, Ill. Folder announcing prefinished coils of nickel steel, chrome steel, copper steel, and brass steel. 51

V-Belts

MANHEIM MFG. & BELTING CO., Manheim, Pa. Catalogue describing the features of an adjustable link type V-belt. 52



Sidney Lathes

INCREASE LIFE OF CARBIDE TOOLS

The continuous tooth contact of Sidney's All-Herringbone Geared Headstock produces a smooth flow of power and creates pressure of constant intensity on the cutting tool . . . This constant pressure is especially desirable when using carbide tools by preventing tool breakage caused by shock or intermittent pressures.

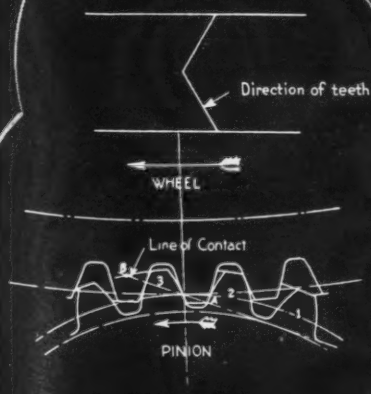


FIG. 9
VIEW IN PLANE OF ROTATION

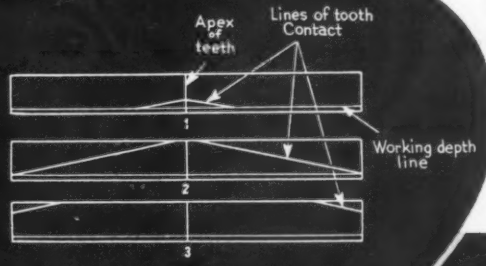
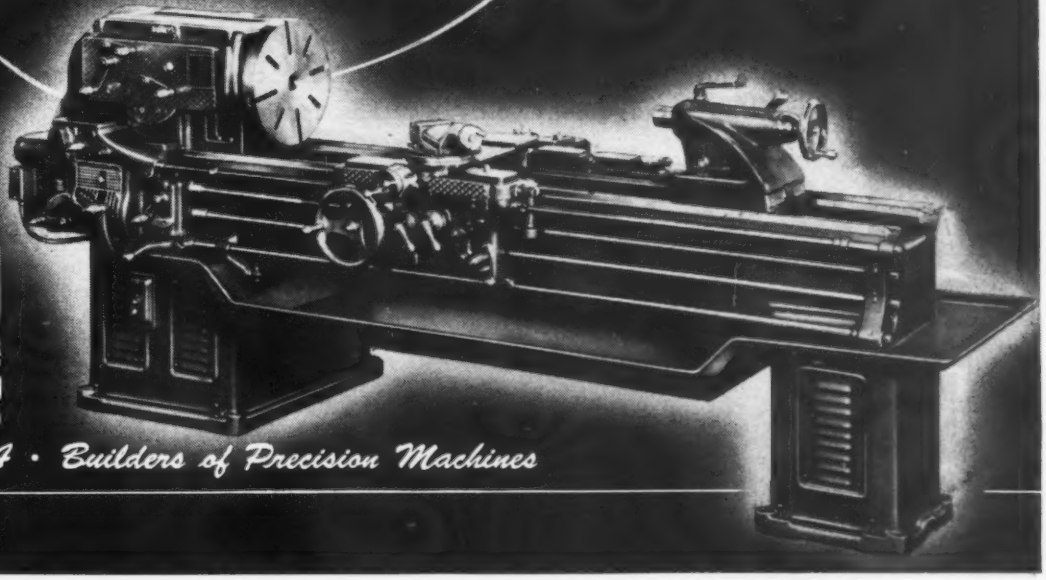


FIG. 10
DEVELOPMENT OF TEETH IN CONTACT.

Illustrated at Left is the nature of contact between two mating herringbone gears. Pressure is evenly divided over three teeth with no tendency for tooth contour to wear unevenly. Full descriptive bulletin available.



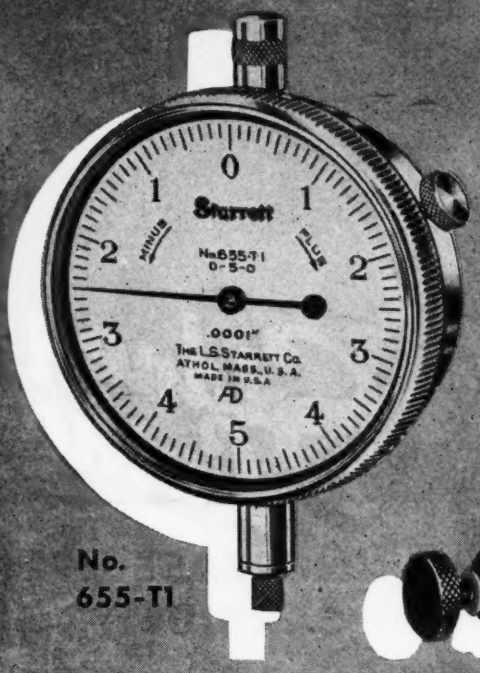
THE SIDNEY MACHINE TOOL COMPANY
SIDNEY • OHIO

Established 1904 • Builders of Precision Machines

SIDNEY

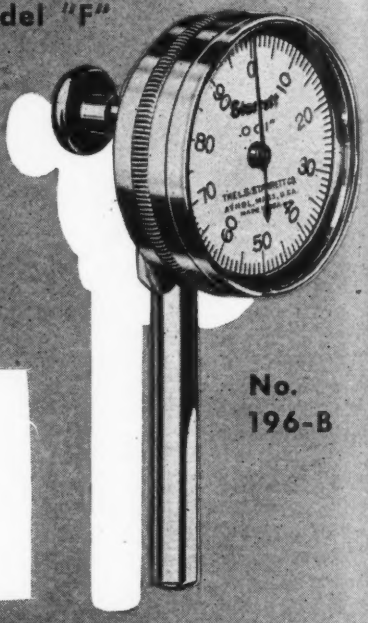
STARRETT DIAL INDICATORS

THREE STARRETT LEADERS



No. 655-T1

LAST WORD
No. 711-F
Model "F"



No. 196-B

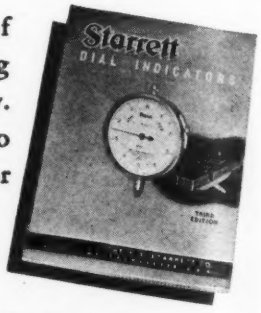
See the Complete Display of

STARRETT TOOLS and DIAL GAGES

BOOTH 200 • MACHINE TOOL SHOW

Dodge-Chicago Plant—September 17-26

In the size and range you need, calibrated as you want it, one of these popular STARRETT Dial Indicators will fit into almost any multiple measuring or production inspection arrangement you can imagine. Write for a copy of STARRETT Dial Indicator Catalog "D" (Third Edition). Keep it handy. It solves the problem of where to find the right Dial Indicator for any application.



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World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK

HACKSAWS • BAND SAWS FOR CUTTING METAL, WOOD, PLASTICS

News of the Industry

California

DIAMOND MACHINE TOOL CO., Los Angeles, Calif., manufacturer of punch presses and milling machines, has added the following members to its sales staff: EDWIN J. RAY, eastern divisional manager; ROBERT W. VACHON, sales manager; and STEPHEN SWIATEK, in charge of advertising and public relations.

HANNIFIN CORPORATION, 1101 S. Kilbourn Ave., Chicago, Ill., has appointed the RIDLEY CO., 320 Eleventh St., San Francisco, Calif., representative for the company's line of hydraulic and pneumatic power and production equipment in northern California.

HERBRAND CORPORATION (now the BINGHAM STAMPING CO.), Fremont, Ohio, manufacturer of tools, has appointed LYNN & BROOKS West Coast sales representatives of the company, with offices in Los Angeles and San Francisco, Calif., and Portland, Ore.

Connecticut and Rhode Island

GEORGE L. NUNN has been appointed southern Connecticut sales engineer for the Austin-Hastings Co., Inc., Machinery Division, Cambridge, Mass., distributor of machine tools and metal-working equipment. He will make his headquarters in the New Haven district. RALPH L. HOHNHORST, who has heretofore covered the whole state of Connecticut, will continue to work from his Hartford office, but will devote his time to central and northern Connecticut.

CHARLES L. JARVIS CO., Middletown, Conn., announces the acquisition of the DOWDING DIVISION OF THE HENRY L. HANSON CO., North Attleboro, Mass., which has been engaged in engineering and finishing of taps and dies.

THOMAS G. HART has been appointed general sales manager of the Whiton Machine Co., New London, Conn., in charge of sales of steam turbines, lathe chucks, centering machines, and gear-cutters.

FRANK U. HAYES, assistant sales manager of the Bullard Co., Bridgeport, Conn., for the last five years, has been named sales manager, and E. PAYSON BLANCHARD, formerly sales manager, has been made director of sales. Mr. Blanchard will be in charge of general administrative sales policies, and Mr. Hayes will be responsible for executive sales functions. Mr. Blanchard has been connected with the Bullard organization since 1920, and Mr. Hayes since 1935.

Frank U. Hayes, Recently Appointed Sales Manager of the Bullard Co.

ARTHUR H. BAINTON recently completed fifty years of service with the Brown & Sharpe Mfg. Co., Providence, R. I. Commemorating the occasion, Henry D. Sharpe, president of the company presented Mr. Bainton with a gold fifty-year service pen. A reception was also given in his honor by present and former presidents of the Foremen's Club. Mr. Bainton started with the company as a machinist a few years after completing an apprenticeship in that trade. He became successively subforeman, assistant department foreman, department foreman, and assistant to the general foreman. Twenty-seven years ago he was appointed works superintendent, and five years later became mechanical superintendent, a position which he held until his elevation to the post of works manager in 1929. In January of this year he assumed his present duties as general consultant. Mr. Bainton is respected by the men at the Brown & Sharpe plant and elsewhere in the machine tool industry for his thorough knowledge of machine tool manufacture and for his deep and active personal interest in all those under his direction.

Arthur H. Bainton, Who has Just Completed Fifty Years with Brown & Sharpe, and is Now General Consultant

District of Columbia and North Carolina

A. B. FARQUHAR CO., York, Pa., manufacturer of hydraulic presses, material handling conveyors, and special machinery, has established a sales office in Washington, D. C., at 1009 Washington Gas Light Bldg., 11th and H Sts., N.W., with C. R. HELLER in charge.

BLACK & DECKER MFG. CO., Towson 4, Md., manufacturer of portable electric tools, has established a new service branch at 117 E. 9th St., Charlotte 6, N. C.

Illinois, Indiana, and Iowa

VASCOLOY-RAMET CORPORATION, North Chicago, Ill., announces the opening of two new branch offices, one at 7041 1/2 Harrisburg Blvd., Houston, Tex., with FRANK H. SCHEFFLER in charge, and the other at 315 Union Arcade Bldg., Davenport, Iowa, with DEAN R. CLINE in charge. The company also announces the appointment of TOOL ENGINEERING SERVICE, located at 505 N. 22nd St., Birmingham, Ala., as agent for Vascoloy-Ramet products.

W. FOSH DEW has been made sales manager of the Clearing Machine Corporation, Chicago, Ill., manufac-

W. Fosh Dew, Newly Appointed Sales Manager of the Clearing Machine Corporation

turer of mechanical hydraulic presses. He was previously assistant sales manager, and has been associated with the corporation since 1940.

HAROLD L. HOEFMAN has been elected vice-president in charge of manufacturing of the Link-Belt Co., with headquarters at the executive offices, 307 N. Michigan Ave., Chicago 1, Ill. Mr. Hoefman has been general manager of the company's Pershing Road plant in Chicago since 1943. EUGENE P. BERG, who has served as assistant to the president since the recent death of E. L. Berry, vice-president in charge of production, has been appointed general superintendent of the Pershing Road plant. JOSEPH C. SPENCE, formerly general superintendent, has been appointed assistant to Mr. Hoefman. RALPH W. RAUSCH, assistant chief engineer since 1933 at the Pershing Road plant, has been appointed chief engineer, succeeding C. S. HUNTINGTON, who has retired because of ill health.

THEODORE E. BURKE has joined the Vanadium Corporation of America, New York 17, N. Y., as sales engineer in the Railroad Division, and will be located at the company's district headquarters in Chicago.

ROBERT C. BECHERER has been appointed plant manager of the Link-Belt Co.'s Ewart plant in Indianapolis, Ind. WARREN H. MAXWELL has been appointed general superintendent of the plant, and S. L. HOUCK becomes assistant general superintendent.

CARBOLOY COMPANY, INC., Detroit 32. Mich., has appointed the SIOUX MACHINERY & SUPPLY CO., Sioux City, Iowa, distributor for Carboloy tools.

Michigan

WALTER F. ROCKWELL and M. M. BURGESS have been elected directors of the E. W. Bliss Co., Detroit, Mich., manufacturer of stamping presses, rolling mills, and can machinery. Mr. Rockwell has been president and a member of the board of directors of the Timken-Detroit Axle Co. since 1940. Mr. Burgess is president of the Scheller Mfg. Corporation, Portland, Ind.

LORNE F. LAVERY has been made manager of the Detroit office of New Departure Division, General Motors Corporation, Bristol, Conn., and CHARLES D. MCCALL, manager of automotive sales, with office in Detroit. Mr. Lavery succeeds F. W. MARSCHNER, who was recently appointed administrative assistant to the general manager.

BROOKS & PERKINS, INC., has recently been formed to take over the business of the former Brooks & Perkins, a partnership, fabricators of magnesium parts and products. Operations will continue in the plant at 1957 W. Lafayette, Detroit, Mich. The president is E. HOWARD PERKINS, and the vice-presidents are OLIVER N. BROOKS and PAUL A. DAY.

T. R. COFFEY has been appointed manager of sales of the Detroit office of the Globe Steel Tubes Co., Milwaukee 4, Wis. Mr. Coffey's headquarters will be in the General Motors Bldg. at Detroit. He previously served as manager of sales at the Milwaukee office, and has been connected with the company in various capacities since 1928.

GEORGE D. PENCE has been appointed president of the Wilson Foundry & Machine Co., Pontiac, Mich. He was formerly in charge of special activities at the Willys-Overland Motors plant. J. G. PAULE, previously assistant general manager, has been named general manager of the foundry.

HOWARD H. HEINZ, INC., manufacturer of Hy-Co center drills, announces that the corporation offices have been moved from 318 Boulevard Bldg., Detroit, Mich., into the company's own plant at 2525 Hilton Road, Detroit 20.

GEORGE L. SHARPE, former sales and service manager of the Michigan Tool Co., is now associated with the American Cutter & Engineering Corporation, Warren, Mich., in a similar capacity.

ROBERT L. STICKLEY has been made distributor promotion specialist for the Carboloy Company, Inc., Detroit, Mich., succeeding T. D. EMERSON.

New York and New Jersey

CARBORUNDUM CO., Niagara Falls, N. Y., announces the purchase of the former assembly plant of Philco Corporation at 3345 W. 47th St., Chicago, Ill., and will use the building as the Chicago sales offices and warehouse of the company. C. E. HAWKE, domestic sales manager, W. C. MCCARGO, regional sales manager, and GORDON C. WATSON, district sales manager will be in charge. The company also announces the breaking of ground at Niagara F...s for the first major building in an extensive construction program of the company, which will involve an expenditure of over $15,000,000. This building will house all maintenance groups of the company, and is expected to be ready for occupancy about January 1.

AMERICAN STANDARDS TESTING BUREAU, INC., 44 Trinity Place, New York 6, N. Y., has recently been organized as an independent agency for sampling, testing, and certifying materials and products to aid consumers, distributors, and producers. The purpose of the new bureau is to expand the testing and quality control services rendered by Sam Tour & Co., Inc., of New York. COLONEL LESLIE S. FLETCHER has been appointed technical director of both companies.

DAVID F. SKLAR, for fourteen years with the Wilson Mechanical Instrument Co., Inc., and for the last ten years chief design and development engineer of the company, has formed a new concern known as the KENT CLIFF LABORATORIES, Peekskill, N. Y., which will be engaged in consulting engineering practice, specializing in the development and manufacture of hardness testing equipment and associated apparatus.

HUGH J. FRASER, vice-president of the International Nickel Co., Inc., New York City, has been placed in charge of all plant operations of the company in the United States. JOHN A. MARSH has been appointed assistant to Mr. Fraser. JOSEPH M. WELDON has been named assistant to H. J. French, vice-president of the company.

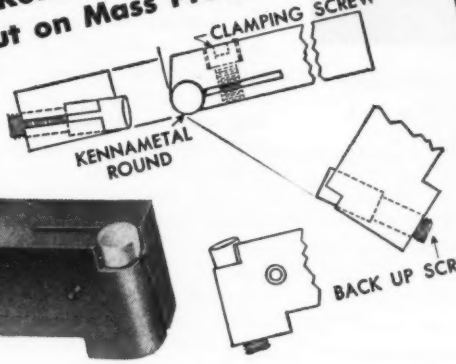
JOHN H. BIGGS, who has been connected with the New York office of Brown & Sharpe of New York, Inc., for several years, has been appointed Rochester representative of the company. EARL P. LEEDS, formerly Rochester representative, has joined the general sales staff of the Brown & Sharpe Mfg. Co., Providence, R. I.

ROBERT O. DEHLENDORF, for the last two years eastern district manager of the Emerson Electric Mfg. Co., has joined the sales staff of Jack &

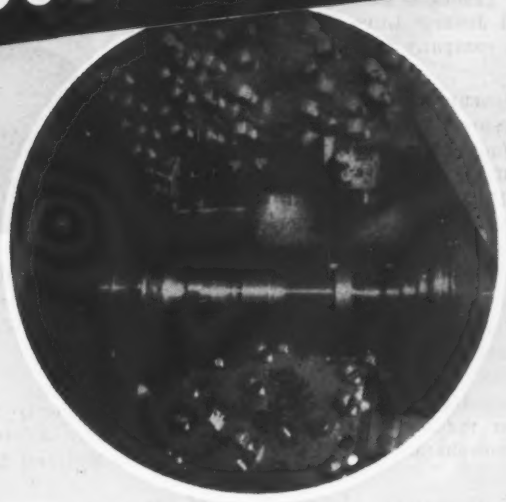
ACTUAL SIZE OF THE KENNAMETAL ROUND INSERT
[Shown with chip breaker ground on both ends.]

KENNAMETAL ROUND MACHINES 89,600 GEARS!

New Kennametal Tool Sustains Output on Mass Production Jobs



STYLE 6RS
[Opposite hand-style 3RS shown on drawing]



Here is a new Kennametal tool that sustains output on mass production jobs, requiring complex tool set-ups.

It comprises a solid Kennametal round, clamped on end in a heat-treated steel holder, and supported by a back-up adjusting screw. Each end of the Kennametal round provides a circular cutting edge. A small section of this edge, depending upon depth of cut, bears against the work. When this section becomes dull, the clamping screw is loosened, and the Kennametal round is revolved around its axis to provide a new cutting edge. The clamping screw is then retightened.

After being thus indexed several times, until all of the cutting edge of one end of the round has become dull, the round is then turned end for end to provide another cycle of cutting. Thus, once the tip is set, it provides a correctly-positioned cutting edge throughout the sequence of indexing of both ends.

When both ends of the Kennametal round have become dull, it is removed from the holder, reground, and thus made ready for another double cutting cycle.

* *Styles 3RS and 6RS tools are described and priced in Catalog 47. Write for a copy.*

The steel cluster gear shown above is a mass production item. Conventional tipped tools limited its output, because of the extensive regrinding involved, periodic adjustment required with a complex set-up, and the necessity for repositioning tools after each regrind.

Solution of this problem was achieved by the use of a distinctive type of tool, utilizing a solid Kennametal round similar to that illustrated and described at the left. The significant fact brought out on this job is the remarkable durability of Kennametal. For example:

Rough turn and face Operation . . . 2,000 gears were machined with both ends of the Kennametal tip before it was reground. The tip was reground on both ends eight times, and machined 16,000 pieces during its life!

Semi-finish Operation—5,600 gears machined with both ends of Kennametal tip before regrinding. Tip was reground on both ends sixteen times, and machined 89,600 pieces!

Finish Operation—3,600 gears machined per double end grind . . . 16 regrinds . . . 57,600 gears machined during the life of the tip!

The tool and the set-up on this job are unusual—complete details will be furnished on request. The performance of Kennametal is not unusual . . . it has been conclusively demonstrated that Kennametal users may get up to 6 times the output per unit of cemented carbide consumed!

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
KENNAMETAL Inc., LATROBE, PA.

Heintz Precision Industries, Inc., Cleveland, Ohio, as eastern district sales manager of the Electric Motor Division. His headquarters will be in New York City.

LUPOMATIC INDUSTRIES, INC., has been organized to take over the former LUPOMATIC TUMBLING MACHINE CO., INC., 4501 Bullard Ave., Bronx, New York, N. Y. CHARLES W. YERGER is president and treasurer and JOSEPH LUPO will continue with the company as vice-president.

JOSEPH J. MAYER has been elected vice-president and director of the Lumen Bearing Co., 197 Lathrop St., Buffalo, N. Y., succeeding the late C. H. Bierbaum. He will continue to serve as general superintendent, a position he has held for more than ten years.

DOUGLAS M. LYON has been appointed sales manager of the Porter-Cable Machine Co., Syracuse, N. Y. succeeding H. L. RAMSAY, who has been made vice-president in charge of merchandising.

E. G. BAILEY, vice-president of the Babcock & Wilcox Co., New York City, has been nominated for president of the American Society of Mechanical Engineers for the year 1947-1948.

ACME TOOL CO. has moved into its own building at 71 W. Broadway, New York 7, N. Y., which affords the company expanded office space and warehouse facilities.

MANHATTAN RUBBER MANUFACTURING DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J., recently received the second award for outstanding excellence in its business magazine advertising during the year 1946-1947, in the National Advertising Agency Network Competition. This marks the fourteenth award received by the company in the fields of advertising, merchandising, and public relations.

DR. HARVEY C. RENTSCHLER retired on July 1 after thirty years service in directing lamp and electronic-tube research for the Westinghouse Electric Corporation at Bloomfield, N. J. DR. CHARLES M. SLACK will succeed him.

Ohio

ALFRED W. SCHULTZ has been appointed director of production and planning control for the Warren City Mfg. Co., Warren, Ohio, manufacturer of fabricated steel frame presses and press brakes. Mr. Schultz was formerly chief engineer of the Verson Allsteel Press Co. and of the Midland Machine Co.

Alfred W. Schultz, Director of Production and Control, Warren City Mfg. Co.

JOHN M. DIEBOLD has been appointed northern Ohio representative, of the Precision Welder & Machine Co., Cincinnati, Ohio. His offices will be at 1921 E. 55th St., Cleveland 3, Ohio. Mr. Diebold recently directed the tooling, processing, and planning of the Rudolph Wurlitzer Co. as chief production engineer. He has been quite active in the American Welding Society's technical activities, and is also a member of several committees of the Society of Automotive Engineers.

HERBRAND CORPORATION, Fremont, Ohio, manufacturer of tools and special drop-forged products, announces the merger of that concern with the BINGHAM STAMPING CO., Toledo, Ohio, maker of brake-lever assemblies for automobiles and trucks and other stamping products. Future operations will be conducted under the name of the Bingham Stampings Co., and manufacturing will be continued at the two plants.

Pennsylvania

KENNAMETAL INC., Latrobe, Pa., announces the following appointments: WILLIAM DALTON HUSTON and D. C. CUNNINGHAM have been added to the staff of application engineers with headquarters at 5531 Woodward Ave., Detroit, Mich. HUGH A. PILLING, 3701 N. Broad St., Philadelphia, Pa., and FRANK E. RYAN, JR., 1537 Main St., Springfield, Mass., have also been added to the staff of application engineers. GILBERT A. BUNN has been made district manager at Philadelphia, with headquarters at 3701 N. Broad St. The following representatives have been appointed: WALTER C. LAVERS and JOSEPH F. LIEBSCHER, both of whom will be located at 3715 Santa Fe Ave., Los Angeles, Calif.; RALPH L. MILLER, 3701 N. Broad St., Philadelphia; CHARLES H. BODNER, 3715 Santa Fe Ave., Los Angeles, Calif.; JOHN H. WRIGHT in the New England district; and RICHARD H. OBERHOLTZER, 5531 Woodward Ave., Detroit, Mich. The company also announces the appointment of LUNDWALL & CO., V. Hamngatan 5, Goteborg, as distributing representative in Sweden.

BETHLEHEM STEEL CO., Bethlehem, Pa., announces the following changes in sales personnel: J. M. ELLIS, general manager of sales, has been appointed assistant to vice-president, and will be succeeded in his former post by K. L. GRIFFITH, previously assistant general manager of sales. D. C. ROSCOE, manager of sales, sheets and strip, has been appointed assistant general manager of sales, and will be succeeded in his previous position by A. T. HUNT, manager of sales, galvanized sheets and formed products. M. C. SCHRADER, assistant to the general manager has been appointed assistant to vice-president.

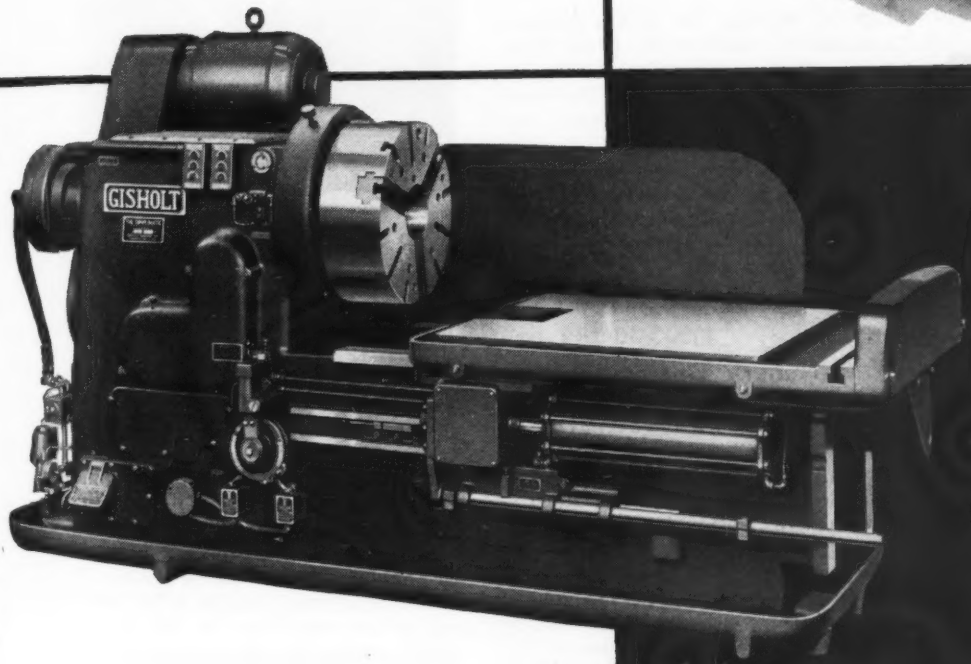
SKF INDUSTRIES, INC., Philadelphia, Pa., announces a two-year modernization and expansion program for its two Philadelphia plants which will involve the expenditure of more than $4,000,000 for new machinery required in the production of anti-friction bearings. The company believes the new program will enable it to increase its output and improve manufacturing efficiency. Some of the machinery has already been installed.

SKF INDUSTRIES, INC., Philadelphia, Pa., announces the following changes in the personnel of its district offices: ROY C. NORTON, JR. has been appointed field engineer at Hartford, Conn.; I. J. TORKELSON, field engineer at Chicago, has been transferred to the Milwaukee office; and R. M. PARRISH has been appointed a member of the sales staff in the Portland, Ore., office.

CALCO MACHINERY CO., 1420 Chestnut St., Philadelphia 2, Pa., has been appointed agent for the machine tools, die-casting machines, and plastic injection molding machines made by the REED-PRENTICE CORPORATION, 677 Cambridge St., Worcester 4, Mass.

GEORGE E. SMITH has been appointed representative in the Middle Atlantic district of Kennametal Inc., Latrobe, Pa., manufacturer of ce-

before you build a Special Machine . . .



investigate the SIMPLIMATIC

PERHAPS you won't have to invest in special equipment after all. For the surprising range of machining problems which the Gisholt Simplimatic solves may include some of your problems, too.

Simple in its basic design, the Simplimatic is a machine which may be individualized for high production on many jobs—with full utilization of the base machine.

The answer to your problem may be found in the wide variety of slide positions possible on the large platen table. Or perhaps through the addition of a tailstock for between-centers work. With a linkage arrangement between slides it will handle spherical boring in conjunction with facing and turning. A vertical head, instead of the horizontal platen, may serve your need. Or you can even set it up for simultaneous double end machining.

Users everywhere are taking advantage of the Simplimatic's varied possibilities to get production on many common and "special" machining jobs. If you have large volume work, where automatic machining can cut costs, investigate the highly adaptable Simplimatic before you have special machines built.

GISHOLT MACHINE COMPANY
Madison 3, Wisconsin

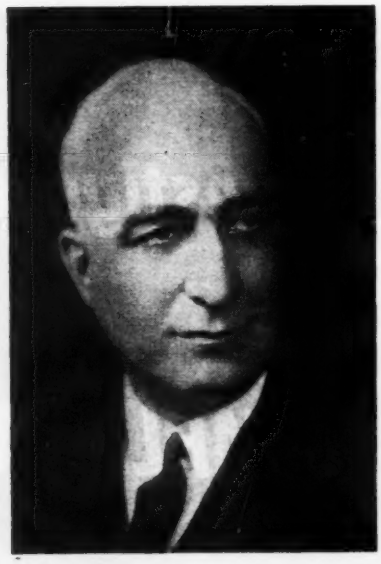
THE GISHOLT ROUND TABLE
represents the collective experience of leading specialists in the machining, surface finishing and balancing of round and semi-round parts. Your problems are welcomed here.

TURRET LATHES · AUTOMATIC LATHES · BALANCERS · SUPERFINISHERS · SPECIAL MACHINES

mented-carbide tools. His headquarters will be at 3701 N. Broad St., Philadelphia, Pa.

THRIFTMASTER PRODUCTS CORPORATION, formerly a division of THOMSON INDUSTRIES, INC., Long Island City, N. Y., has recently moved its plant and offices to Lancaster, Pa.

BERTON H. DELONG has been appointed vice-president and technical director of the Carpenter Steel Co., Reading, Pa. He was previously vice-president and chief metallurgist. GEORGE B. LUERSSEN succeeds Mr. DeLong as chief metallurgist, being promoted to that position from the post of assistant chief metallurgist.



Berton H. DeLong, Newly Appointed Technical Director, Carpenter Steel Co.

George B. Luerssen, New Chief Metallurgist of the Carpenter Steel Co.

Wisconsin

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., announces that it has started a construction and expansion program for the Pittsburgh works of the company, which will cost several million dollars. The first step in the program will be the construction of a 250- by 400-foot building which will be devoted largely to the production of transformers. Another smaller building at the New River plant will be used for shipping. It is planned to increase the present employment of 1600 at Pittsburgh by one-quarter to one-third and to expand the productive capacity about 50 per cent.

D. F. WENZEL has been appointed manager of sales of the Globe Steel Tubes Co., at Milwaukee, Wis. He has been connected with the company for the last eleven years, and replaces T. R. COFFEY, who has been made manager of sales at Detroit. Mr. Coffey has been manager of sales at the Wisconsin office since 1943, and has been connected with the company since 1928.

* * *

Machinery Dealers Elect New Officers

George McClennen, of the Delta Equipment Co., Philadelphia, Pa., was elected president of the Machinery Dealers' National Association at the sixth annual meeting of the organization held in Cincinnati, June 17 to 19. The other officers elected are: First vice-president, Ralph Hochman, of Ralph Hochman & Co., Newark, N. J.; second vice-president, Joseph T. Weiss, Interstate Machinery Co., Inc., Chicago, Ill.; and treasurer Charles Simmons, Sr., Simmons Machine Tool Corporation, Albany, N. Y. The executive director of the Association is Randolph K. Vinson, 1301 Enquirer Bldg., Cincinnati, Ohio.

* * *

New Officers of Drop Forging Association

At the twelfth annual meeting of the Drop Forging Association, held at the General Brock Hotel, Niagara Falls, Canada, in June, Raymond B. Tripp, executive vice-president of the Ohio Forge & Machine Corporation, Cleveland, Ohio, was elected president, and Ralph A. Mitchell, vice-president of Pittsburgh Forgings Co., Coraopolis, Pa., was elected vice-president. R. M. Seabury, who has served continuously for twelve years as secretary-treasurer was re-elected. The headquarters of the Association are at 605 Hanna Bldg., Cleveland, Ohio.

Obituaries

Raymond R. Ridgway

Raymond R. Ridgway, assistant director of research of the Norton Co., at Chippawa, Ontario, Canada, died on June 12 at the age of fifty years. It is believed that he fell from his sailboat, which was anchored about 60 feet off shore in the Niagara River. His body was recovered in the river on June 15.

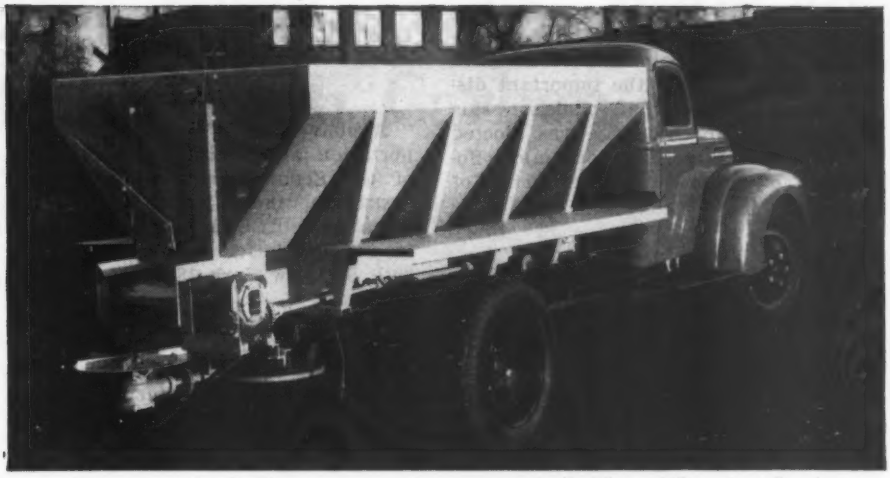
Mr. Ridgway was born in Morris, Ill., and graduated from Massachusetts Institute of Technology in 1920. An outstanding research man in electrochemistry during the past quarter of a century, he had to his credit a long list of inventions and improvements in the design of electric furnaces for the production of abrasives and improvements in the manufacture of fused alumina, silicon carbide, and magnesia, and in the production of hard metal carbides. He was given the Jacob F. Schoellkopf Medal in 1943, awarded annually by the Western New York Section of the American Chemical Society for distinguished research and achievements in chemistry.

His crowning accomplishments in the abrasive field were the discovery and commercial production of Norbide and the invention of the new abrasive, 32 Alundum. Much of his work for the Norton Co. was at Chippawa, where he was in charge of technical control of standard products and research development of new products and methods.

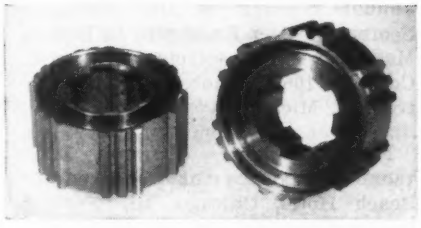
The production of Alundum to exacting quality specifications had been accomplished under Mr. Ridgway's supervision for many years. He studied continuously the electric furnace process of manufacture, and made changes many times to obtain an even more uniform product effi-

GEAR HIGHLIGHTS

VOL. XI NO. 4

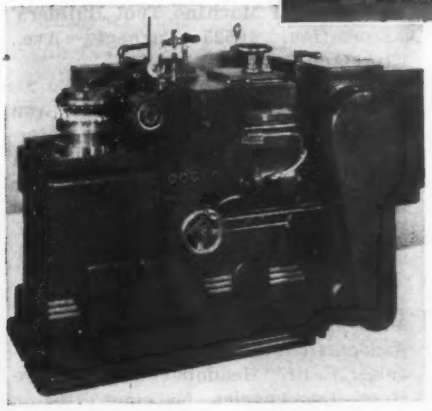


Conveyorized lime spreader operated through standard reducer *(See NEW WESTON CONE-DRIVE LIME SPREADER, p. 2 of GEAR HIGHLIGHTS).*

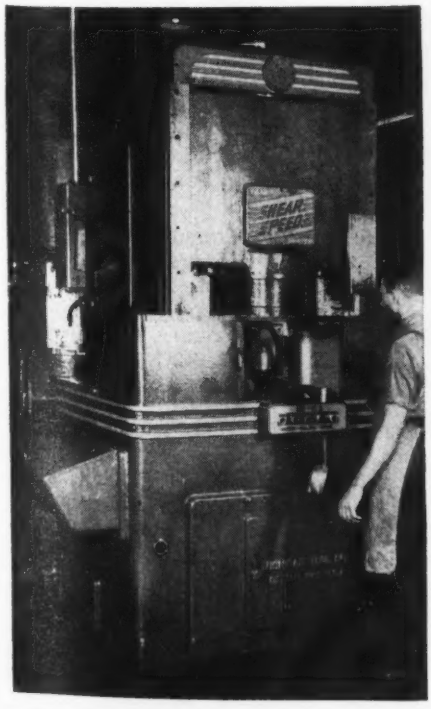


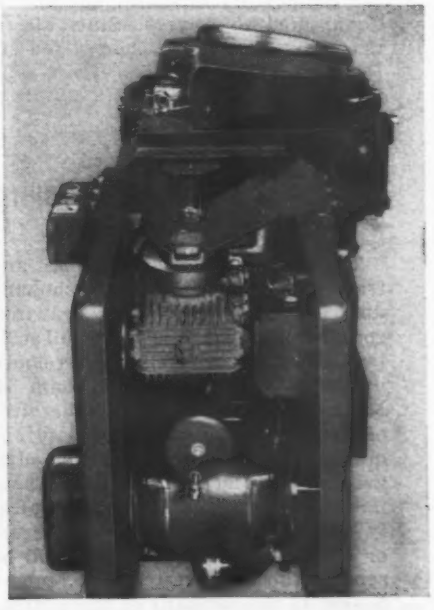
Precision cutting eliminates need for lapping Cone-Drives. *(See PRODUCING CONE-DRIVES on page 3 of GEAR HIGHLIGHTS).*

A single machine finish cuts transmission shifter clutch hubs at Ford at two every 55 seconds. *(See "SHEAR-SPEED," page 2 of GEAR HIGHLIGHTS).*



Below: "New" gears save space, increase acceleration and deceleration rate without high inertia loads. *(See FLASH-WELDER PROBLEMS SOLVED, page 2 of GEAR HIGHLIGHTS).*





We will be glad to send you the current issue of GEAR HIGHLIGHTS VOL. XI, NO. 4 giving the complete story on the above developments.

MICHIGAN TOOL COMPANY 7171 East McNichols Road DETROIT 12, - - U.S.A.

ciently. His knowledge and ability also resulted in the control of Crystolon, and many patents were assigned to him, indicating the important discoveries that he had made on this abrasive. Mr. Ridgway was elected president of the Electrochemical Society of America in the spring of 1941.

Thomas C. Delaval-Crow

Thomas Clive Delaval-Crow, for twenty-six years chief engineer of the New Departure Division of General Motors at Bristol, Conn., died at his home in Bristol on June 28, following a prolonged illness. He was sixty-one years of age. Mr. Crow was born in Oxford, England, and was educated at the Oxford High School and the Crystal Palace School of Engineering in London. He came to this country in 1907, and joined New Departure in 1914, being made chief engineer in 1921. Mr. Crow was treasurer of the Southern New England Section of the Society of Automotive Engineers, and a past-chairman of the Annular Bearings Engineers Committee.

HARRY A. MAURER, former general superintendent, director, and secretary of the Oster Mfg. Co., Cleveland, Ohio, died on June 17 after an illness of several months at the age of seventy years. Mr. Maurer was well known throughout the machinery industry, and was considered an outstanding authority on advanced shop practices. He had been associated with the company since 1905, but had retired from active duty about a year ago, serving in a consulting capacity until his recent illness.

WALTER F. HENLY, retired sales manager of the New York office of the Hendey Machine Co., Torrington, Conn., died on July 13. Since his retirement Mr. Henly had lived in Hohokus, N. J.

* * *

Indicator Drafting Templets for Fixture Design

Tool designers, draftsmen, and tracers will find the task of showing dial indicators on fixture drawings speeded up by the use of full-scale indicator drafting templets developed by the B. C. Ames Co., Waltham 54, Mass. Three views of all four sizes of Ames dial indicators are laid out on the templets, as well as dial graduations and other details. These templets enable the dials to be quickly traced without the use of a scale or dividers. A set of templets will be sent to those interested if a request is sent to the company at the address given above.

Coming Events

AUGUST 21-22 — West Coast transportation and maintenance meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 1-4—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Utah, Salt Lake City, Utah. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 8-12—SECOND NATIONAL INSTRUMENT CONFERENCE AND INSTRUMENT EXHIBIT in Chicago, Ill., under the auspices of the Instrument Society of America. Further information can be obtained from T. W. Robinson, Chairman, Exhibit Committee, 236 N. Clark St., Chicago 1, Ill.

SEPTEMBER 17-18 — Tractor meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Schroeder, Milwaukee, Wis. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 17-26 — MACHINE TOOL SHOW at the Dodge-Chicago plant, Chicago, Ill., under the auspices of the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio.

SEPTEMBER 17-26—PRODUCTION AND MACHINE TOOL SHOW at the International Amphitheater, 42nd and Halsted Sts., Chicago, Ill. Further information can be obtained from the Production and Machine Tool Show, 3 Bridge St., Grafton, Wis.

SEPTEMBER 18-20—Twenty-fourth annual convention of the NATIONAL ASSOCIATION OF FOREMEN in Los Angeles, Calif. Headquarters Biltmore Hotel, Los Angeles. National director of publicity, Ken Wells, Biltmore Hotel, Los Angeles, Calif.

OCTOBER 2-4—Autumn Aeronautic meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel in Los Angeles, Calif. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

OCTOBER 18-24—Twenty-ninth annual NATIONAL METAL CONGRESS AND EXPOSITION at the International Amphitheater, Chicago Ill., sponsored by the American Society for Metals. W. H. Eisenman, national secretary of the American Society for Metals and managing director of the exposition, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 20-24—Annual meeting of the AMERICAN SOCIETY FOR METALS at the Palmer House, Chicago, Ill. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 20-24—Annual meeting of the AMERICAN WELDING SOCIETY at the Hotel Sherman, Chicago, Ill. Secretary, M. M. Kelly, 33 W. 39th St., New York 18, N. Y.

OCTOBER 20-24—Annual meeting of the AMERICAN INDUSTRIAL RADIUM & X-RAY SOCIETY at the Continental Hotel, Chicago, Ill. Secretary, Philip D. Johnson, 53 W. Jackson Blvd., Chicago 4, Ill.

OCTOBER 23-25—INDUSTRIAL MANAGEMENT CONFERENCE at the University of Missouri, Columbia, Mo. Further information can be obtained from Robert P. Alberts, executive secretary and publicity chairman of the conference, University of Missouri, Columbia, Mo.

OCTOBER 30 - NOVEMBER 1 — Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS in Boston, Mass. Executive secretary, Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, Mich.

NOVEMBER 3-5 — NATIONAL ELECTRONICS CONFERENCE at the Edgewater Beach Hotel, Chicago, Ill. Further information can be obtained from H. S. Renne, 185 N. Wabash Ave., Chicago 1, Ill.

NOVEMBER 6-7—Fuels and Lubricants meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS, at the Hotel Mayo, Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-3—Air Transport meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Continental, Kansas City, Mo. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

JANUARY 12-16, 1948—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

MARCH 15-21, 1948 — Sixteenth annual meeting and Tool Exhibition of the AMERICAN SOCIETY OF TOOL ENGINEERS in Cleveland, Ohio. Harry E. Conrad, executive secretary, 1666 Penobscot Bldg., Detroit 26, Mich.

Stronger, Lighter Hand Truck Made by Welding Tubular High Carbon Steel

BY JAMES B. HOWLAND, PARTNER
TUBAR BENDING & MANUFACTURING CO., CLEVELAND, OHIO

THE new Tubar Hand Truck has outstanding strength and low weight because it is made of tubular high carbon steel with an exceptionally thin wall (.076″). Frame of the largest model Tubar weighs only 36 pounds, yet carries a 1,000-lb. load. Fig. 1 shows how light it is. The addition of reinforcing tubes from the kick-bar to the handle (see Fig. 3) makes a "stevedore" model with a 2,500-lb. capacity. Conventional hand trucks of these capacities weigh more than twice as much.

The all-welded tubular frame has other advantages in addition to lightness. Constructed without bolts or rivets, it has a smooth top and bed without obstructions. There is no danger from wood splinters or sharp edges of metal. Design of the frame distributes the load and reduces dead weight on the axle, facilitating handling. The operator's hands follow the curve of the handle in "breaking" the load to a pulling or pushing position. The Tubar Truck is patented.

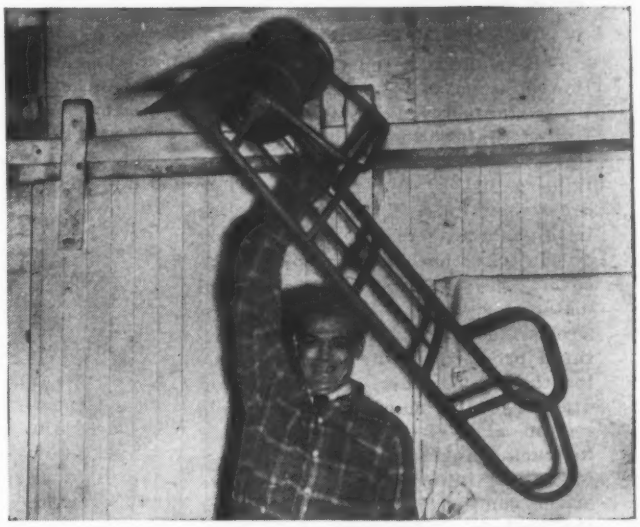


Fig. 1. Demonstrating the lightness of the Tubar truck.

JIGS USED IN WELDING

We use two sizes of tubing—1 1/16″ O.D. and 7/8″ O.D. The smaller telescopes into the larger size at the maximum stress point, for greater strength. The tubes are bent on a bending machine (see Fig. 2). The toe plates are bevelled and forged to a point. Toe-plate sides are cut from 3/4″ high carbon steel plate by an acetylene cutting machine. The frame parts are assembled in a jig and tack-welded, then finish-welded in another jig (see Fig. 3).

In setting up production, we had difficulty welding the high carbon tubing until we tried the new Lincoln "Shield-Arc LH-70" electrode, designed for high carbon and other difficult-to-weld steels. With "Shield-Arc LH-70" we are able to weld speedily without costly preheating or special welding procedures.

Engineers and designers may obtain Studies in Machine Design by writing THE LINCOLN ELECTRIC COMPANY, Dept. 227 Cleveland 1, Ohio.

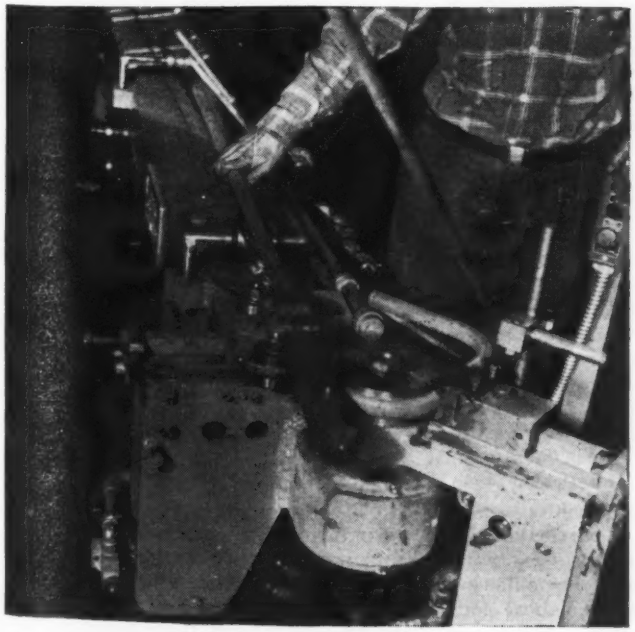


Fig. 2. All bending is performed on a tube bending machine.

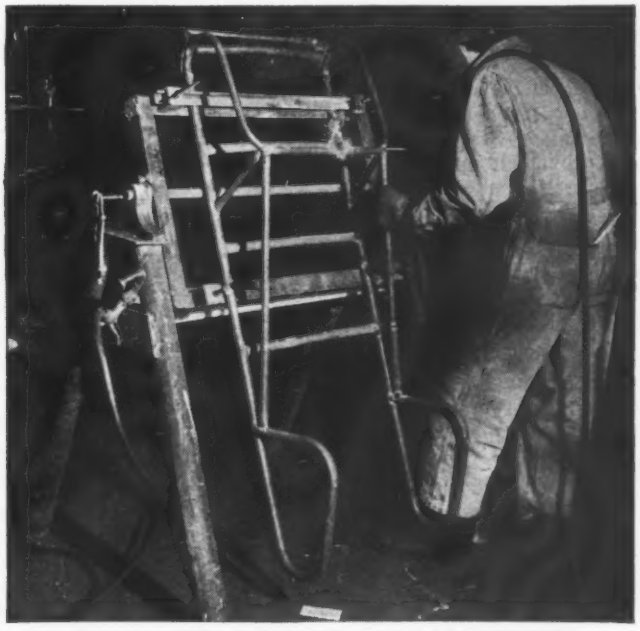


Fig. 3. Finish-welding a "stevedore" model. Jig rotates so most welding is in downhand position.

New Books and Publications

MACRAE'S BLUE BOOK. 3740 pages, 8 1/2 by 11 inches. Published by MacRae's Blue Book Co., 18 E. Huron St., Chicago 11, Ill. Price, $15.

This is the fifty-fourth annual edition of a buying guide covering all the manufactured products in the United States. The book consists of three sections, the first of which contains a list of the names and addresses of manufacturers arranged in alphabetical order. The second, or main section of the book, which covers 3000 pages, is the classified material section, in which is given a classified list of all the manufactured products in the United States, together with the names and addresses of the manufacturers. This section also gives a capital rating for each manufacturer, which is useful in obtaining an idea of the size of the concern. The third section of the book is a directory of products identified by trade names, arranged alphabetically according to the trade name and including the name and address of the manufacturer in each case. This comprehensive directory should be useful not only to buyers, but also to sales departments, and others who require to make a list of products or of firms for various purposes.

HOW TO OPERATE UNDER THE NEW LABOR LAW. Published by the Labor Relations Institute, 1776 Broadway, New York 19, N. Y. Price, $2.

The effect of the new Labor-Management Relations (Taft-Hartley) Act upon employers, unions, and employes, is explained in this timely report. The booklet compares the new law with the Wagner Act, and analyzes its effect in states that have previously passed similar restrictive laws. It shows in exactly what ways management's position is improved and strengthened, and what individual rights previously denied to workers can now be exercised by them. Information is given on the new limitations on unions and the added powers accruing to Government under the new law. Questions and answers on each section of the Act are included.

INDUSTRIAL DIRECTORY OF MEXICO. 1947-1948 edition. 1024 pages. Published by Publicacions Rolland, S. de R. L., Plaza de la Republica No. 6-407, Mexico, D. F. Price, $20.

Sponsored by the Confederation of Industrial Chambers of Mexico, this is the first comprehensive directory ever published on Mexican industry. It includes a list of all Mexican industrial companies, their addresses, and the names of their presidents, vice-presidents, advertising managers, and buyers; describes the raw materials used by each company and the products they manufacture; and gives data on capitalization and number of employes. A special Spanish-English dictionary covering most of the words in the publication is included.

APPLIED ENGINEERING MECHANICS. By Alfred Jensen. 316 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $3.

This is an elementary text-book on engineering mechanics, designed to meet the requirements of a beginner's course. The book is divided into two parts, treating of statics and dynamics. In the section on statics, the problems most commonly encountered in practice have been given special emphasis. Analytical and graphical solutions are presented side by side. The use of mathematics has been kept to a minimum. The many illustrative examples, problems, and review questions are an important feature of the book.

MANAGEMENT AND HUMAN RELATIONS IN INDUSTRY. 103 pages, 8 1/2 by 11 inches. Published by Industrial Relations Publishing Corporation, 1165 Broadway, New York 1, N. Y. Price, $2.

This is Volume 1 of the Labor and Industrial Relations Year Book and Directory for 1947. It comprises a symposium on the subject of management, containing chapters by different authors on various phases, including human relations; the Lincoln Electric Co.'s incentive system; multiple management; collective bargaining; the 100 per cent reserve plan; agriculture; taxation and ability to pay; strikes; etc.

SPRING DESIGN AND CALCULATIONS. Compiled by John A. Roberts, Technical Research Laboratory, Herbert Terry & Sons, Ltd., of England, designers and manufacturers of springs. 114 pages, 4⅞ by 7⅝ inches. Distributed by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Price, 10/6d.

Essential data that permits user to design a spring for a particular purpose is presented in this book without unnecessary theory. Formulas are included for calculating helical compression and extension, square and rectangular section, volute, conical, valve, flat, and leaf springs.

HARDENABILITY OF ALLOY STEELS. Published by the Society of Automotive Engineers, Inc., 29 W. 39th St., New York 18, N. Y. Price, $1 to S A E members; $2 to others.

This treatise, published jointly by the Society of Automotive Engineers and the American Iron and Steel Institute, comprises data on designing, testing, and ordering steels on the basis of hardenability. It covers sixty-two tentative hardenability-band steels, twenty-five of which are listed here for the first time.

DIRECTORY OF SWISS MACHINES, APPARATUS, AND TOOLS. Published by the Office for Industrial Information, Directory of Machines Department, 4 Tour-de-L'Ile, Geneva, Switzerland. Price, twelve Swiss fancs.

This directory published in French, German, English, and Spanish gives the addresses of all the Swiss manufacturers of machines, apparatus, and tools. It is published in handy pocket size, and equipped with a thumb-index to the different languages.

EVALUATION OF EFFECTS OF TORSIONAL VIBRATION. (Second Printing) 576 pages, 8½ by 11 inches. Published by the Society of Automotive Engineers, Inc., 29 W. 39th St., New York 18, N. Y. Price to members of the Society, $5; to non-members, $10.

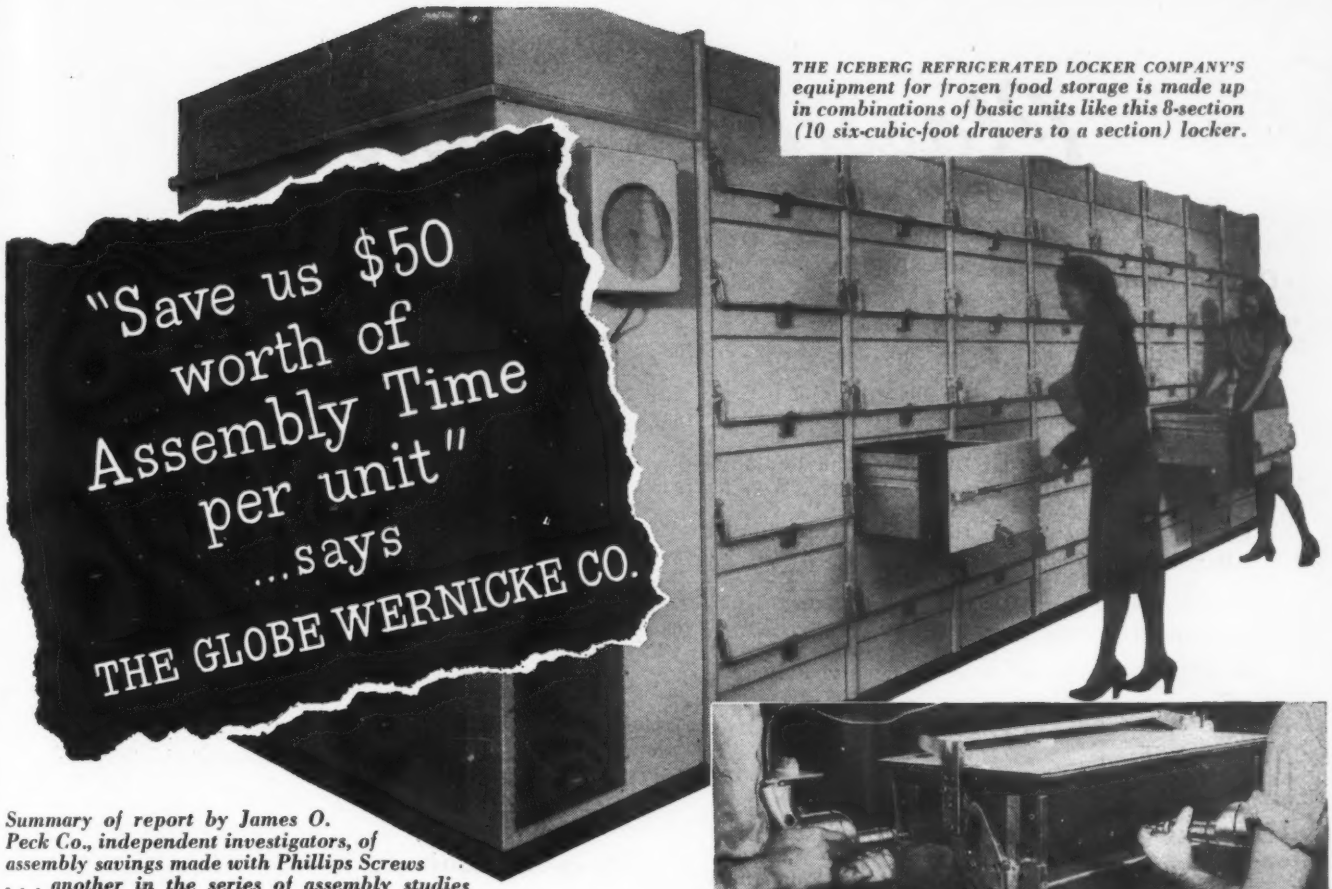
* * *

Computer for Determining Tensile Strength

A handy slide-rule device is being distributed by W. C. Dillon & Co., Inc., for quickly determining the breaking strength of different sizes and types of specimens. It is merely necessary to set the computer at the size of the specimen and then read the total breaking strength, in pounds, opposite the tensile strength, in pounds per square inch. Conversely, the area required for a given breaking strength can be readily determined.

The device covers rectangular specimens from 1/32 to 1/4 inch thick by 1/2 to 1 1/2 inches wide, with tensile strengths ranging up to 150,000 pounds per square inch; as well as rounds from 1/16 to 1 inch in diameter with tensile strengths up to 100,000 pounds per square inch.

Engineers can obtain one of these computers without charge by sending a request, together with their full name, the company with whom they are associated, and their position, to W. C. Dillon & Co., Inc., 5410 W. Harrison, Chicago 44, Ill.



THE ICEBERG REFRIGERATED LOCKER COMPANY'S equipment for frozen food storage is made up in combinations of basic units like this 8-section (10 six-cubic-foot drawers to a section) locker.

Summary of report by James O. Peck Co., independent investigators, of assembly savings made with Phillips Screws . . . another in the series of assembly studies at prominent plants.

● "We manufacture these units for the Iceberg Refrigerated Locker Systems, Inc," explained the assembly head of The Globe Wernicke. "Our engineering department specified Phillips Screws throughout, and we're glad they did.

"Save us $50 worth of assembly time per unit. We can take full advantage of power drivers with Phillips Screws. No finder is needed and there's no fumbling such as we'd have with slotted screws. Since each unit requires thousands of screws, $50 is a conservative estimate of how much we save per unit by using Phillips Screws.

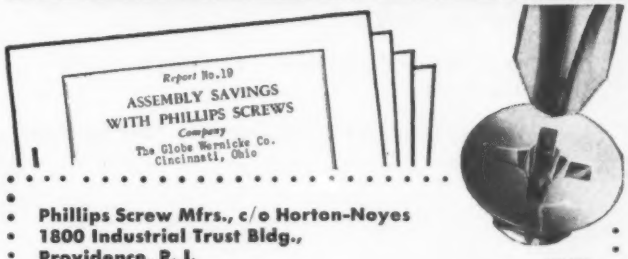
"Upside down or sideways . . . Makes no difference. Screws are driven with the unit in one position so that much of the driving is sideways or upside down. Difficult with slotted screws but very easy with Phillips Screws.

"No gouging or burring. Before we settled on Phillips, we tried out a lot of other type screws and found the driver would jump out and gouge the Masonite panels or burr the heads. Phillips Screws ended that, gave us better driving time with our power drivers."

Help yourself to money-saving ideas for your assembly operations. Write for the full report on The Globe Wernicke Co. and other assembly studies . . . covering metal, wood and plastic products. Use the coupon.

The complicated assembly of the drawer of the ICEBERG REFRIGERATED LOCKER . . . made without driver skids to injure work or hands, thanks to Phillips Screws.

Most of the thousands of Phillips Screws used in this assembly are Type "A", self-tapping, and are power driven up, down, and sideways.



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
Elco Tool & Screw Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.

24 SOURCES

National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Strongheld Screw Products, Inc.
Wolverine Bolt Company

Phillips Screw Mfrs., c/o Horton-Noyes
1800 Industrial Trust Bldg.,
Providence, R. I. 20-M

Send me reports on Assembly Savings with Phillips Screws.

Name .....

Company .....

Address .....

Classified Contents

Design, Machine

Diemaking, Die Design, and Press Work

Management Problems

Materials, Metals, and Alloys

Meetings and Exhibitions

News of Industry

Shop Practice

Your Progress Depends Upon Your Knowledge of Your Industry

MACHINERY'S DATA SHEETS 569 and 570

DIE STEELS FOR COLD-WORKING DIES—1

Type of Steel	Characteristics	Tendency* Distortion	Comparative Wear Resistance†	Relative Toughness‡	Relative Ease of Machining¶
Water-Hardening					
Straight Carbon (with 0.8 to 1.1 per cent C)	High hardness; low hardening temperature; shallow hardening; depth of hardening can be specified and controlled; easily machined and ground. Insufficient case depth for many jobs; danger of soft spots; risk of cracking and warping; insufficient wear resistance for long runs.	1	1	6	6
Carbon-Vanadium (carbon steel with about 0.25 per cent V)	Compared with straight carbon steel, carbon-vanadium steel has finer grain and wider hardening range; greater toughness; shallower depth of hardening; case depth can be increased by quenching from higher temperatures.	2	1	7	6
Oil-Hardening					
Manganese (1 per cent Mn with Cr and W; and 1 1/2 per cent Mn with Mo)	Low hardening temperature; little danger of cracking even in intricate sections; low distortion; easy to machine and grind; moderately deep hardening; fair wear resistance and ability to hold cutting edge; low toughness.	3	2	3	5
High-Carbon, High-Chromium (2.2 per cent C, 12 per cent Cr)	High hardening temperature; little danger of cracking; low distortion; difficult to machine and grind; deep hardening; superlative wear resistance and compressive strength; low toughness.	5	6	1	1

*For signification of the numbers in the right-hand columns, see notes at bottom of Data Sheet No. 570.

NOTE: The distortion and toughness ratings of water-hardening steels depend on the relative proportions of hard case to tough core. The case expands, while the core contracts. Certain water-hardening dies may be so proportioned as to show negligible change. Similarly, the case is quite brittle; but with sufficient core beneath it, the die will be very tough.

MACHINERY'S Data Sheet No. 569, September, 1946

Compiled by G. M. Butler, Allegheny Ludlum Steel Corporation, Pittsburgh, Pa.

DIE STEELS FOR COLD-WORKING DIES—2

Type of Steel	Characteristics	Distortion Tendency*	Comparative Wear Resistance†	Relative Toughness‡	Relative Ease of Machining¶
Air-Hardening					
Manganese-Chromium-Molybdenum (2 to 3 per cent Mn; 1 to 2 per cent Cr; 1 per cent Mo)	Low hardening temperature; negligible cracking hazard; least distortion of all tool steels; rather difficult to machine; quite easy to grind; deep hardening; moderately tough; somewhat better wear resistance than manganese oil-hardening steel; limited availability.	7	3	4	3
Chromium-Molybdenum (5 per cent Cr; 1 per cent Mo)	Intermediate hardening temperature; negligible cracking hazard; low distortion, but more than manganese-chromium-molybdenum; deep hardening; toughest of all alloy die steels; wear resistance about like that of manganese-chromium-molybdenum steel.	4	4	5	4
High-Carbon, High-Chromium (1.5 per cent C; 12 per cent Cr; with some Mo)	High hardening temperature; negligible cracking hazard; almost as low distortion as manganese-chromium-molybdenum steel; deep hardening; low toughness; excellent wear resistance.	6	5	2	2

*The figure 1 represents the greatest tendency toward distortion; 7, the least tendency.

†1 stands for the lowest wear resistance value; 6, highest wear resistance.

‡1 stands for the lowest toughness; 7, greatest toughness.

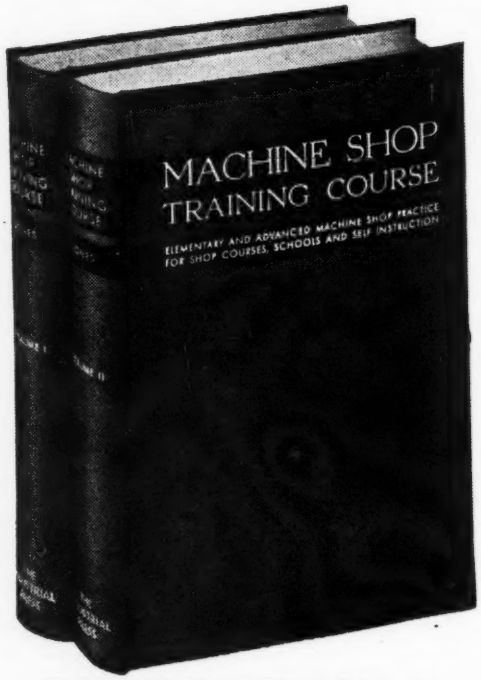
¶1 stands for steel most difficult to machine; 6, for steel easiest to machine.

MACHINERY'S Data Sheet No. 570, September, 1946

Compiled by G. M. Butler, Allegheny Ludlum Steel Corporation, Pittsburgh, Pa.

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS



Price $6 Set—Payable $2 with Order, $2 Monthly

This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains over 1100 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Gear Design Simplified

Size 8-1/2 x 11 Inches

This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm-gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price $3 copy.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

SYNCHRONOUS MOTOR "TROUBLE-SHOOTING" CHART—3

Trouble	Cause	Remedy
Motor "hunts"	**Fluctuating load**	Correct excessive torque peak at driven machine or consult motor manufacturer. If driven machine is a compressor, check valve operations. Increase or decrease flywheel size. Try decreasing or increasing motor field current.
Stator overheats in spots	Rotor not centered	Realign and shim stator or bearings.
	Open phase	Check connections and correct.
	Unbalanced currents	Check for loose connections; check for improper internal connections.
One or more coils overheat	Short circuit	Cut out coil as expedient (in motors up to 5 H.P.); replace coil when the opportunity arises.
Field overheats	Short circuit in a field coil	Replace or repair.
	Excessive field current	Reduce excitation until stator current is at nameplate value.
All parts overheat	Overload	Reduce load or increase motor size. Check friction and belt tension, or alignment.
	Over or under excitation	Adjust excitation to nameplate rating.
	No field excitation	Check circuit and exciter.
	Reverse field coil	Check polarity, and if wrong, change leads.
	Improper voltage	See that nameplate voltage is applied.
	Improper ventilation	Remove any obstruction and clean out dirt.
	Excessive room temperature	Supply cooler air.

MACHINERY'S Data Sheet No. 571, October, 1946

Compiled by the General Electric Co. Schenectady, N. Y.

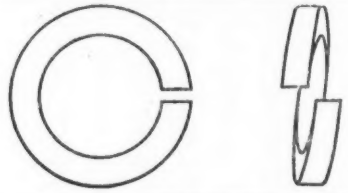
SOME COMMON GEAR DIFFICULTIES AND HOW TO OVERCOME THEM

Some of the Troubles to be Overcome	Gears Most Subject to Trouble	Cause	Method of Correcting
Abrasive Wear or Scoring	Spur, Helical, and Bevel Gears	Misalignment or rough surfaces; improper tooth contact; sliding under heavy load; too low oil viscosity; low starting temperatures	Increase oil viscosity; use oil with mild non-corrosive E.P. additive; use means for preheating to raise the starting temperature.
Galling	Spiral, Bevel, and Hypoid Gears	Oil-film rupture; high surface temperatures	Use oil with mild non-corrosive E.P. additive; use means for cooling to reduce temperatures.
Pitting	Any or All Types of Gears	Occurs with rolling, as well as with combined rolling and sliding, when oil is too low in viscosity. More prevalent on rough surface finishes or where local tooth overload prevails	Use an E.P. oil; increase the oil viscosity; try to get gears of better surface finish; increase the surface hardness or metal toughness. Improve tooth alignment and load uniformity by shimming under bearings or adding outboard bearings to overhung pinions.
Burning	Any or All Types of Gears	Overload or lack of lubrication	Run under conditions for which gear was designed. Lubricate.

MACHINERY'S Data Sheet No. 572, October, 1946

Compiled by The Texas Company New York 17, N. Y.

AMERICAN STANDARD SPRING LOCK-WASHERS—1



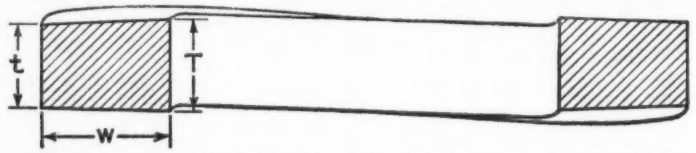
Material: Carbon Steel with a Rockwell Hardness of 47-53C

Nominal Size	Inside Diameter, Min.	Clearance of Nominal Bolt Size		Outside Diameter, Maximum (Allowances have been made for commercial tolerances on cold-drawn wire and hot-rolled rod)			
		Min.	Max.	Light	Medium	Heavy	Extra Heavy
0.086 (No. 2)	0.088	0.002	0.011	0.165	0.175	0.185	0.211
0.099 (No. 3)	0.102	0.002	0.011	0.188	0.198	0.212	0.242
0.112 (No. 4)	0.115	0.003	0.012	0.202	0.212	0.226	0.256
0.125 (No. 5)	0.128	0.003	0.012	0.225	0.239	0.255	0.303
0.138 (No. 6)	0.141	0.003	0.013	0.237	0.251	0.267	0.315
0.164 (No. 8)	0.168	0.004	0.014	0.280	0.296	0.310	0.378
0.190 (No. 10)	0.194	0.004	0.015	0.323	0.337	0.353	0.437
0.216 (No. 12)	0.221	0.005	0.016	0.364	0.380	0.394	0.500
1/4	0.255	0.005	0.017	0.489	0.493	0.495	0.539
5/16	0.319	0.006	0.020	0.575	0.591	0.601	0.627
3/8	0.382	0.007	0.023	0.678	0.688	0.696	0.746
7/16	0.446	0.008	0.026	0.780	0.784	0.792	0.844
1/2	0.509	0.009	0.029	0.877	0.879	0.889	0.945
9/16	0.573	0.010	0.032	0.975	0.979	0.989	1.049
5/8	0.636	0.011	0.035	1.082	1.086	1.100	1.164
11/16	0.700	0.012	0.038	1.178	1.184	1.200	1.266
3/4	0.763	0.013	0.041	1.277	1.279	1.299	1.369
13/16	0.827	0.014	0.044	1.375	1.377	1.401	1.473
7/8	0.890	0.015	0.047	1.470	1.474	1.504	1.586
15/16	0.954	0.016	0.050	1.562	1.570	1.604	1.698
1	1.017	0.017	0.053	1.656	1.672	1.716	1.810
1 1/16	1.081	0.018	0.056	1.746	1.768	1.820	1.922
1 1/8	1.144	0.019	0.059	1.837	1.865	1.921	2.031
1 3/16	1.208	0.020	0.062	1.923	1.963	2.021	2.137
1 1/4	1.271	0.021	0.065	2.012	2.058	2.126	2.244
1 5/16	1.335	0.022	0.068	2.098	2.156	2.226	2.350
1 3/8	1.398	0.023	0.071	2.183	2.253	2.325	2.453
1 7/16	1.462	0.024	0.074	2.269	2.349	2.421	2.555
1 1/2	1.525	0.025	0.077	2.352	2.446	2.518	2.654

Note: Washers are specified by nominal size and series; for example: 1/4 inch light, 1/4 inch medium, 1/4 inch heavy, or 1/4 inch extra heavy.

MACHINERY'S Data Sheet 573, November, 1946 Compiled by American Standards Association

AMERICAN STANDARD SPRING LOCK-WASHERS—2



Nominal Size	Washer Sections (Minimum)*							
	Light		Medium		Heavy		Extra Heavy	
	Width w	Nominal Mean Thickness $\frac{T+t}{2}$	Width w	Nominal Mean Thickness $\frac{T+t}{2}$	Width w	Nominal Mean Thickness $\frac{T+t}{2}$	Width w	Nominal Mean Thickness $\frac{T+t}{2}$
0.086 (No. 2)	0.030	0.015	0.035	0.020	0.040	0.025	0.053	0.027
0.099 (No. 3)	0.035	0.020	0.040	0.025	0.047	0.031	0.062	0.034
0.112 (No. 4)	0.035	0.020	0.040	0.025	0.047	0.031	0.062	0.034
0.125 (No. 5)	0.040	0.025	0.047	0.031	0.055	0.040	0.079	0.045
0.138 (No. 6)	0.040	0.025	0.047	0.031	0.055	0.040	0.079	0.045
0.164 (No. 8)	0.047	0.031	0.055	0.040	0.062	0.047	0.096	0.057
0.190 (No. 10)	0.055	0.040	0.062	0.047	0.070	0.056	0.112	0.068
0.216 (No. 12)	0.062	0.047	0.070	0.056	0.077	0.063	0.130	0.080
1/4	0.107	0.047	0.109	0.062	0.110	0.077	0.132	0.084
5/16	0.117	0.056	0.125	0.078	0.130	0.097	0.143	0.108
3/8	0.136	0.070	0.141	0.094	0.145	0.115	0.170	0.123
7/16	0.154	0.085	0.156	0.109	0.160	0.133	0.186	0.143
1/2	0.170	0.099	0.171	0.125	0.176	0.151	0.204	0.162
9/16	0.186	0.113	0.188	0.141	0.193	0.170	0.223	0.182
5/8	0.201	0.126	0.203	0.156	0.210	0.189	0.242	0.202
11/16	0.216	0.138	0.219	0.172	0.227	0.207	0.260	0.221
3/4	0.233	0.153	0.234	0.188	0.244	0.226	0.279	0.241
13/16	0.249	0.168	0.250	0.203	0.262	0.246	0.298	0.261
7/8	0.264	0.179	0.266	0.219	0.281	0.266	0.322	0.285
15/16	0.277	0.191	0.281	0.234	0.298	0.284	0.345	0.308
1	0.289	0.202	0.297	0.250	0.319	0.306	0.366	0.330
1 1/16	0.301	0.213	0.312	0.266	0.338	0.326	0.389	0.352
1 1/8	0.314	0.224	0.328	0.281	0.356	0.345	0.411	0.375
1 3/16	0.324	0.234	0.344	0.297	0.373	0.364	0.431	0.396
1 1/4	0.336	0.244	0.359	0.312	0.393	0.384	0.452	0.417
1 5/16	0.346	0.254	0.375	0.328	0.410	0.403	0.472	0.438
1 3/8	0.356	0.264	0.391	0.344	0.427	0.422	0.491	0.458
1 7/16	0.366	0.273	0.406	0.359	0.442	0.440	0.509	0.478
1 1/2	0.375	0.282	0.422	0.375	0.458	0.458	0.526	0.496

*Washer sections are slightly trapezoidal in shape, with the thickness at the inner periphery greater than the thickness at the outer periphery by an amount varying from a minimum of 0.0005 inch to a maximum of 0.001 inch per 1/64 inch of section width.

MACHINERY'S Data Sheet 574, November, 1946 Compiled by American Standards Association

CHECKING EXTERNAL GEAR SIZES BY MEASUREMENT OVER WIRES—1

Even Numbers of Teeth

The dimensions given in this table are for 1 diametral pitch gears and wires of 1.68-inch diameter. For checking gears of any other pitch, divide the dimensions given by the diametral pitch and use wires having a diameter equal to $\frac{1.68}{\text{diametral pitch}}$

No. of Teeth	Pressure Angle				
	14½°	17½°	20°	25°	30°
6	8.1298	8.1442	8.1600	8.2003	8.2504
8	10.1535	10.1647	10.1783	10.2155	10.2633
10	12.1712	12.1796	12.1914	12.2260	12.2722
12	14.1851	14.1910	14.2013	14.2338	14.2785
14	16.1964	16.2001	16.2091	16.2397	16.2833
16	18.2058	18.2076	18.2154	18.2445	18.2871
18	20.2137	20.2138	20.2205	20.2483	20.2902
20	22.2205	22.2190	22.2249	22.2515	22.2927
22	24.2265	24.2235	24.2286	24.2542	24.2949
24	26.2317	26.2275	26.2318	26.2566	26.2967
26	28.2363	28.2309	28.2346	28.2586	28.2982
28	30.2404	30.2339	30.2371	30.2603	30.2996
30	32.2441	32.2367	32.2392	32.2619	32.3008
32	34.2475	34.2391	34.2412	34.2632	34.3017
34	36.2505	36.2413	36.2430	36.2644	36.3026
36	38.2533	38.2433	38.2445	38.2655	38.3035
38	40.2558	40.2451	40.2460	40.2666	40.3044
40	42.2582	42.2468	42.2473	42.2675	42.3051
42	44.2604	44.2483	44.2485	44.2683	44.3057
44	46.2624	46.2497	46.2496	46.2690	46.3063
46	48.2642	48.2510	48.2506	48.2697	48.3068
48	50.2660	50.2522	50.2516	50.2704	50.3073
50	52.2676	52.2534	52.2525	52.2710	52.3078
52	54.2691	54.2545	54.2533	54.2716	54.3082
54	56.2705	56.2555	56.2541	56.2721	56.3086
56	58.2719	58.2564	58.2548	58.2726	58.3089
58	60.2731	60.2572	60.2555	60.2730	60.3093
60	62.2743	62.2580	62.2561	62.2735	62.3096
62	64.2755	64.2587	64.2567	64.2739	64.3099
64	66.2765	66.2594	66.2572	66.2742	66.3102
66	68.2775	68.2601	68.2577	68.2746	68.3104
68	70.2785	70.2608	70.2582	70.2749	70.3107
70	72.2794	72.2615	72.2587	72.2752	72.3109
72	74.2803	74.2620	74.2591	74.2755	74.3111
74	76.2811	76.2625	76.2596	76.2758	76.3113
76	78.2819	78.2631	78.2600	78.2761	78.3115
78	80.2827	80.2636	80.2604	80.2763	80.3117
80	82.2834	82.2641	82.2607	82.2766	82.3119
82	84.2841	84.2646	84.2611	84.2768	84.3121
84	86.2847	86.2650	86.2614	86.2771	86.3123
86	88.2854	88.2655	88.2617	88.2773	88.3124
88	90.2860	90.2659	90.2620	90.2775	90.3126

MACHINERY'S Data Sheet No. 575, December, 1946 Compiled by The Van Keuren Co. Boston, Mass.

CHECKING EXTERNAL GEAR SIZES BY MEASUREMENT OVER WIRES—2

Even Numbers of Teeth

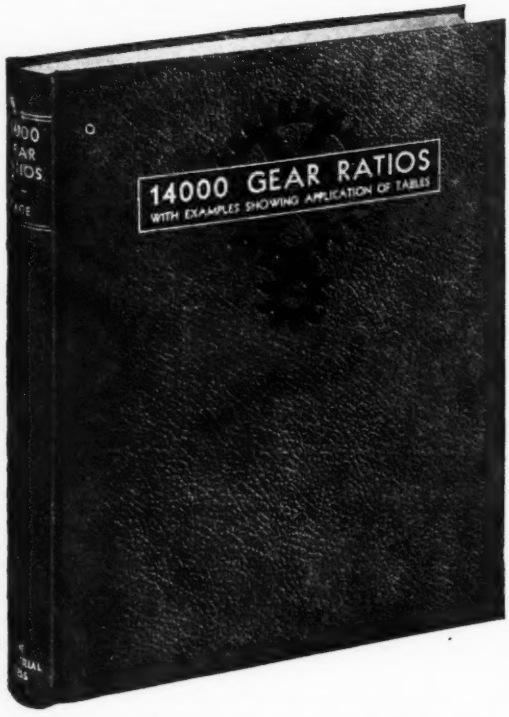
No. of Teeth	Pressure Angle				
	14½°	17½°	20°	25°	30°
90	92.2866	92.2662	92.2624	92.2777	92.3127
92	94.2872	94.2666	94.2627	94.2779	94.3129
94	96.2877	96.2670	96.2630	96.2780	96.3130
96	98.2882	98.2673	98.2632	98.2782	98.3131
98	100.2887	100.2677	100.2635	100.2784	100.3132
100	102.2892	102.2680	102.2638	102.2785	102.3134
102	104.2897	104.2683	104.2640	104.2787	104.3135
104	106.2901	106.2685	106.2642	106.2788	106.3136
106	108.2905	108.2688	108.2644	108.2789	108.3137
108	110.2910	110.2691	110.2645	110.2791	110.3138
110	112.2914	112.2694	112.2647	112.2792	112.3139
112	114.2918	114.2696	114.2649	114.2793	114.3140
114	116.2921	116.2699	116.2651	116.2794	116.3141
116	118.2925	118.2701	118.2653	118.2795	118.3142
118	120.2929	120.2703	120.2655	120.2797	120.3142
120	122.2932	122.2706	122.2656	122.2798	122.3143
122	124.2936	124.2708	124.2658	124.2799	124.3144
124	126.2939	126.2710	126.2660	126.2800	126.3145
126	128.2941	128.2712	128.2661	128.2801	128.3146
128	130.2945	130.2714	130.2663	130.2802	130.3146
130	132.2948	132.2716	132.2664	132.2803	132.3147
132	134.2951	134.2718	134.2666	134.2804	134.3147
134	136.2954	136.2720	136.2667	136.2805	136.3148
136	138.2957	138.2722	138.2669	138.2806	138.3149
138	140.2960	140.2724	140.2670	140.2807	140.3149
140	142.2962	142.2725	142.2671	142.2808	142.3150
142	144.2965	144.2727	144.2672	144.2808	144.3151
144	146.2967	146.2729	146.2674	146.2809	146.3151
146	148.2970	148.2730	148.2675	148.2810	148.3152
148	150.2972	150.2732	150.2676	150.2811	150.3152
150	152.2974	152.2733	152.2677	152.2812	152.3153
152	154.2977	154.2735	154.2678	154.2812	154.3153
154	156.2979	156.2736	156.2679	156.2813	156.3154
156	158.2981	158.2737	158.2680	158.2813	158.3155
158	160.2983	160.2739	160.2681	160.2814	160.3155
160	162.2985	162.2740	162.2682	162.2815	162.3155
162	164.2987	164.2741	164.2683	164.2815	164.3156
164	166.2989	166.2742	166.2684	166.2816	166.3156
166	168.2990	168.2744	168.2685	168.2816	168.3157
168	170.2992	170.2745	170.2686	170.2817	170.3157
170	172.2994	172.2746	172.2687	172.2818	172.3158
180	182.3003	182.2752	182.2691	182.2820	182.3160
190	192.3011	192.2757	192.2694	192.2823	192.3161
200	202.3018	202.2761	202.2698	202.2825	202.3163
300	302.3063	302.2790	302.2719	302.2839	302.3173
400	402.3087	402.2804	402.2730	402.2845	402.3178
500	502.3101	502.2813	502.2736	502.2850	502.3181

These data for 1 diametral pitch gears and 1.68-inch diameter wires are based on the Buckingham formulas for measurement of external spur gears over wires.

MACHINERY'S Data Sheet No. 576, December, 1946 Compiled by The Van Keuren Co. Boston, Mass.

14000 Gear Ratios

With Examples Showing Use of Tables



This book contains about 400 pages of tabulated gear ratios and examples—14000 two-gear, and millions of possible four-gear combinations. The tables are presented in both common fractional and decimal forms and are divided into four main sections. These sections are arranged differently to facilitate solving, by simple direct methods, any type of gear ratio problem likely to arise.

SECTION 1—Common Fractional Ratios and Decimal Equivalents.

SECTION 2—Decimal Ratios, Logs and Equivalent Pairs of Gears.

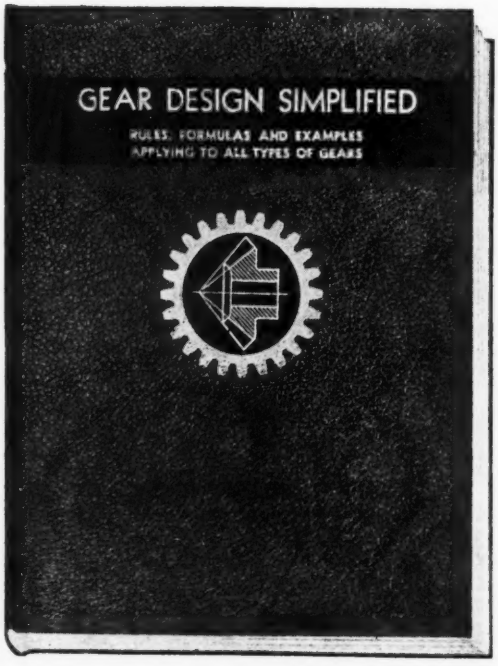
SECTION 3—Total Number of Teeth with Equivalent Gear Pairs and Ratios.

SECTION 4—Numbers and Equivalent Gear Factors.

Book is 8-1/2 x 11 Inches. Price, $5 copy

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Gear Design Simplified



Size 8-1/2 x 11 Inches

This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price $3 copy.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

CHECKING EXTERNAL GEAR SIZES BY MEASUREMENT OVER WIRES—3

Odd Numbers of Teeth

The dimensions given in this table are for 1 diametral pitch gears and wires of 1.68-inch diameter. For checking gears of any other pitch, divide the dimensions given by the diametral pitch and use wires having a diameter equal to $\frac{1.68}{\text{diametral pitch}}$

No. of Teeth	Pressure Angle				
	14½°	17½°	20°	25°	30°
5	6.8485	6.8639	6.8800	6.9202	6.9691
7	8.9555	8.9679	8.9822	9.0199	9.0675
9	11.0189	11.0285	11.0410	11.0762	11.1224
11	13.0615	13.0686	13.0795	13.1126	13.1575
13	15.0925	15.0973	15.1068	15.1381	15.1819
15	17.1163	17.1190	17.1273	17.1570	17.1998
17	19.1351	19.1360	19.1432	19.1716	19.2136
19	21.1505	21.1498	21.1561	21.1832	21.2245
21	23.1634	23.1611	23.1665	23.1926	23.2334
23	25.1743	25.1707	25.1754	25.2005	25.2408
25	27.1836	27.1788	27.1828	27.2071	27.2469
27	29.1918	29.1859	29.1892	29.2128	29.2522
29	31.1990	31.1920	31.1948	31.2177	31.2568
31	33.2053	33.1974	33.1997	33.2220	33.2607
33	35.2110	35.2021	35.2041	35.2258	35.2642
35	37.2161	37.2065	37.2079	37.2292	37.2674
37	39.2208	39.2104	39.2115	39.2323	39.2702
39	41.2249	41.2138	41.2147	41.2349	41.2726
41	43.2287	43.2170	43.2174	43.2374	43.2749
43	45.2323	45.2199	45.2200	45.2396	45.2769
45	47.2355	47.2226	47.2224	47.2417	47.2788
47	49.2385	49.2251	49.2246	49.2435	49.2805
49	51.2413	51.2273	51.2266	51.2452	51.2820
51	53.2439	53.2294	53.2284	53.2468	53.2835
53	55.2463	55.2313	55.2302	55.2483	55.2848
55	57.2485	57.2331	57.2318	57.2497	57.2861
57	59.2506	59.2348	59.2333	59.2509	59.2872
59	61.2526	61.2363	61.2347	61.2521	61.2883
61	63.2545	63.2378	63.2360	63.2532	63.2893
63	65.2562	65.2392	65.2372	65.2543	65.2902
65	67.2579	67.2406	67.2383	67.2553	67.2911
67	69.2594	69.2419	69.2394	69.2562	69.2920
69	71.2609	71.2431	71.2405	71.2571	71.2928
71	73.2623	73.2442	73.2414	73.2579	73.2935
73	75.2636	75.2452	75.2423	75.2586	75.2942
75	77.2649	77.2462	77.2432	77.2594	77.2949
77	79.2661	79.2472	79.2440	79.2601	79.2955
79	81.2673	81.2481	81.2448	81.2607	81.2961
81	83.2684	83.2490	83.2456	83.2614	83.2967
83	85.2694	85.2498	85.2463	85.2620	85.2972
85	87.2704	87.2506	87.2470	87.2625	87.2977
87	89.2714	89.2514	89.2476	89.2631	89.2982
89	91.2723	91.2521	91.2482	91.2636	91.2987
91	93.2732	93.2528	93.2489	93.2641	93.2991
93	95.2741	95.2534	95.2495	95.2646	95.2996

MACHINERY'S Data Sheet No. 577, January, 1947 Compiled by The Van Keuren Co. Boston, Mass.

CHECKING EXTERNAL GEAR SIZES BY MEASUREMENT OVER WIRES—4

Odd Numbers of Teeth

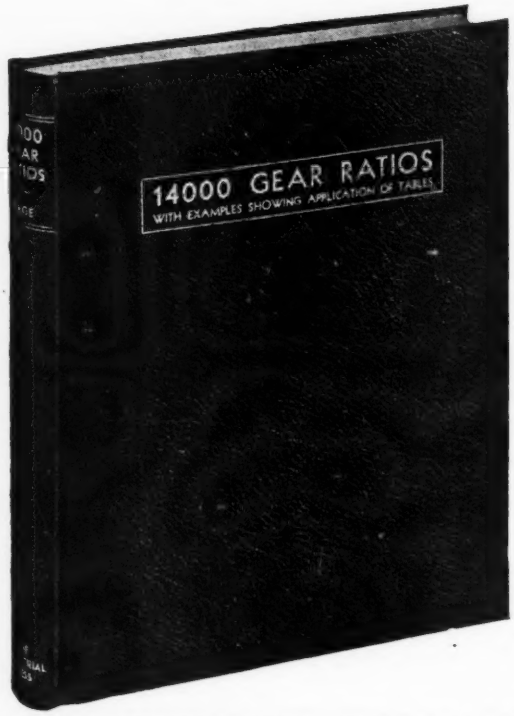
No. of Teeth	Pressure Angle				
	14½°	17½°	20°	25°	30°
95	97.2749	97.2541	97.2500	97.2650	97.3000
97	99.2757	99.2547	99.2506	99.2655	99.3004
99	101.2764	101.2553	101.2511	101.2659	101.3008
101	103.2771	103.2558	103.2516	103.2663	103.3011
103	105.2778	105.2563	105.2520	105.2667	105.3015
105	107.2785	107.2568	107.2525	107.2671	107.3018
107	109.2791	109.2573	109.2529	109.2674	109.3021
109	111.2798	111.2578	111.2533	111.2678	111.3024
111	113.2804	113.2583	113.2537	113.2681	113.3027
113	115.2809	115.2588	115.2541	115.2684	115.3030
115	117.2815	117.2592	117.2544	117.2687	117.3033
117	119.2821	119.2596	119.2548	119.2690	119.3036
119	121.2826	121.2601	121.2552	121.2693	121.3038
121	123.2831	123.2605	123.2555	123.2696	123.3041
123	125.2836	125.2608	125.2558	125.2699	125.3043
125	127.2841	127.2612	127.2562	127.2702	127.3046
127	129.2846	129.2615	129.2565	129.2704	129.3048
129	131.2851	131.2619	131.2568	131.2707	131.3050
131	133.2855	133.2622	133.2571	133.2709	133.3053
133	135.2859	135.2626	135.2574	135.2712	135.3055
135	137.2863	137.2629	137.2577	137.2714	137.3057
137	139.2867	139.2632	139.2579	139.2716	139.3059
139	141.2871	141.2635	141.2582	141.2718	141.3060
141	143.2875	143.2638	143.2584	143.2720	143.3062
143	145.2879	145.2641	145.2587	145.2722	145.3064
145	147.2883	147.2644	147.2589	147.2724	147.3066
147	149.2887	149.2647	149.2591	149.2726	149.3068
149	151.2890	151.2649	151.2594	151.2728	151.3069
151	153.2893	153.2652	153.2596	153.2730	153.3071
153	155.2897	155.2654	155.2598	155.2732	155.3073
155	157.2900	157.2657	157.2600	157.2733	157.3074
157	159.2903	159.2659	159.2602	159.2735	159.3076
159	161.2906	161.2661	161.2604	161.2736	161.3077
161	163.2909	163.2663	163.2606	163.2738	163.3078
163	165.2912	165.2665	165.2608	165.2740	165.3080
165	167.2915	167.2668	167.2610	167.2741	167.3081
167	169.2917	169.2670	169.2611	169.2743	169.3083
169	171.2920	171.2672	171.2613	171.2744	171.3084
171	173.2922	173.2674	173.2615	173.2746	173.3085
181	183.2936	183.2684	183.2623	183.2752	183.3091
191	193.2947	193.2692	193.2630	193.2758	193.3097
201	203.2957	203.2700	203.2636	203.2764	203.3101
301	303.3022	303.2749	303.2678	303.2798	303.3132
401	403.3056	403.2774	403.2699	403.2815	403.3147
501	503.3076	503.2789	503.2711	503.2825	503.3156
∞	(N+2).3159	(N+2).2849	(N+2).2762	(N+2).2866	(N+2).3194

These data for 1 diametral pitch gears and 1.68-inch diameter wires are based on the Buckingham formulas for measurement of external spur gears over wires.

MACHINERY'S Data Sheet No. 578, January, 1947 Compiled by The Van Keuren Co. Boston, Mass.

14000 Gear Ratios

With Examples Showing Use of Tables



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SECTION 4—Numbers and Equivalent Gear Factors.

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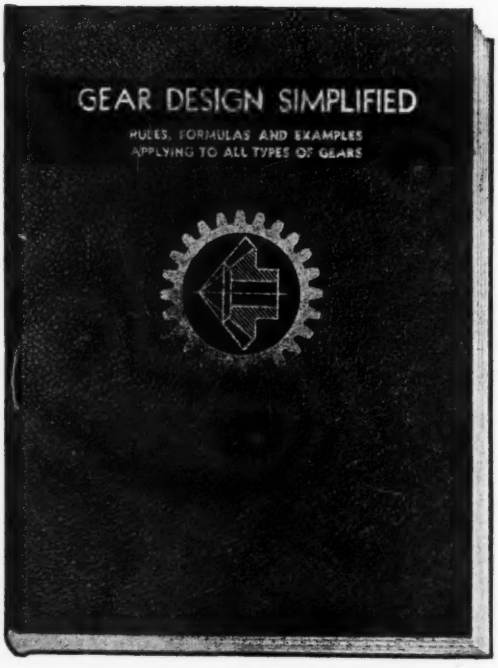
Gear Design Simplified



Size 8-1/2 x 11 Inches

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MACHINERY'S DATA SHEETS 579 and 580

SAFE FEEDS AND SPEEDS FOR HIGH-SPEED STEEL TWIST DRILLS—1

Drill Diam., Inch	Cast Iron		Bronze or Brass		Drop-Forgings, Alloy Steels, or Tool Steels, Annealed		Drop-Forgings, Alloy Steels, or Tool Steels, Heat-Treated		Steel Castings		Mild Steel	
	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.
1/16	0.002	4550	0.002	9150	0.002	3650	0.002	2750	0.002	3650	0.002	4250
	0.004	6700	0.004	12000	0.003	4550	0.003	3650	0.003	4550	0.003	5600
1/8	0.002	2550	0.002	4550	0.002	1800	0.002	1225	0.002	1800	0.002	2100
	0.004	3350	0.004	5600	0.003	2250	0.003	1800	0.003	2250	0.003	2800
3/16	0.004	1500	0.004	3100	0.003	1200	0.003	900	0.003	1200	0.003	1400
	0.006	2200	0.007	5600	0.004	1500	0.004	1200	0.005	1500	0.005	1900
1/4	0.004	1150	0.004	2300	0.003	925	0.003	750	0.003	925	0.003	1050
	0.006	1650	0.007	2750	0.004	1150	0.004	925	0.005	1150	0.005	1500
5/16	0.006	925	0.007	1825	0.004	725	0.004	500	0.004	725	0.005	850
	0.009	1325	0.010	2200	0.006	925	0.005	725	0.006	925	0.007	1200
3/8	0.006	750	0.007	1525	0.004	600	0.004	400	0.004	600	0.005	700
	0.009	1100	0.010	1850	0.006	750	0.005	600	0.006	750	0.007	925
7/16	0.009	650	0.010	1300	0.006	525	0.005	350	0.006	525	0.006	600
	0.012	950	0.014	1525	0.009	650	0.006	525	0.010	650	0.010	800
1/2	0.009	575	0.010	1150	0.006	375	0.005	300	0.006	375	0.006	525
	0.012	850	0.014	1375	0.009	575	0.006	375	0.010	575	0.010	700
9/16	0.012	500	0.014	1000	0.008	350	0.007	275	0.010	350	0.010	575
	0.016	750	0.018	1200	0.012	500	0.010	350	0.014	500	0.014	625
5/8	0.012	450	0.014	900	0.008	300	0.007	250	0.010	300	0.010	425
	0.016	675	0.018	1100	0.012	450	0.010	300	0.014	450	0.014	565
11/16	0.012	410	0.014	800	0.008	275	0.007	225	0.010	275	0.010	375
	0.016	625	0.018	1000	0.012	410	0.010	275	0.014	410	0.014	525
3/4	0.012	375	0.014	750	0.008	250	0.007	200	0.010	250	0.010	350
	0.016	550	0.018	900	0.012	375	0.010	250	0.014	375	0.014	475

MACHINERY'S Data Sheet No. 579, February, 1947 Compiled by Chicago-Latrobe Twist Drill Works

SAFE FEEDS AND SPEEDS FOR HIGH-SPEED STEEL TWIST DRILLS—2

Drill Diam., Inch	Cast Iron		Bronze or Brass		Drop-Forgings, Alloy Steels, or Tool Steels, Annealed		Drop-Forgings, Alloy Steels, or Tool Steels, Heat-Treated		Steel Castings		Mild Steel	
	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.	Feed, Inch per Rev.	Speed, Rev. per Min.
13/16	0.014	350	0.016	700	0.010	240	0.009	190	0.014	240	0.014	325
	0.020	525	0.022	850	0.014	350	0.012	240	0.016	350	0.016	450
7/8	0.014	325	0.016	650	0.010	225	0.009	175	0.014	225	0.014	300
	0.020	475	0.022	800	0.014	325	0.012	225	0.016	325	0.016	400
15/16	0.014	300	0.016	625	0.010	200	0.009	160	0.014	200	0.014	275
	0.020	450	0.022	725	0.014	300	0.012	200	0.016	300	0.016	375
1	0.014	280	0.016	575	0.010	185	0.009	150	0.014	185	0.014	265
	0.020	425	0.022	675	0.014	280	0.012	185	0.016	280	0.016	350

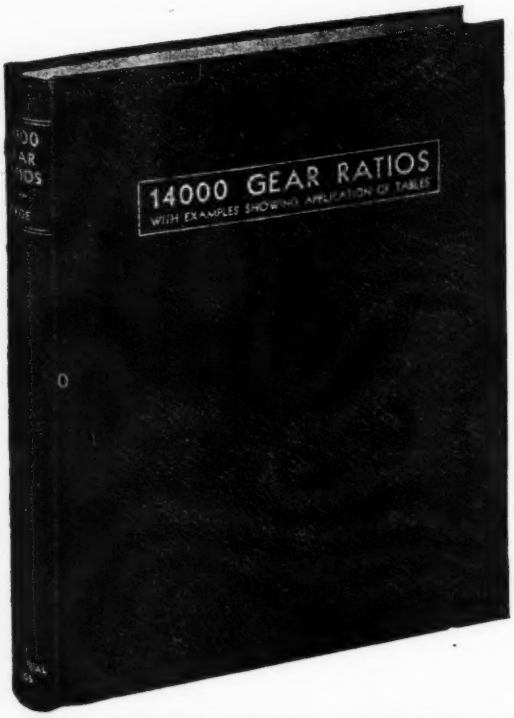
The speeds and feeds shown apply to average working conditions and materials, and are recommended with regard to conserving drills and avoiding excessive machine tool wear. Under many conditions, these speeds or feeds may be decreased or increased, depending upon the performance obtained and the judgment of the operator. It is best to start an operation at the lowest speed and feed recommended for the size of drill being used and material being drilled. If the drill and machine run smoothly, without strain, both feed and speed can be increased. Excessive speeds and feeds can be detected from the action of the machine and drill.

Liberal use of cooling compound will increase the life of drills. Proper grinding is essential. A drill should never be dipped into water to cool during grinding. This causes tiny checks or cracks at the cutting edges which result in rapid dulling of the drill. A drill should be reground immediately when it shows signs of dulling.

MACHINERY'S Data Sheet No. 580, February, 1947 Compiled by Chicago-Latrobe Twist Drill Works

14000 Gear Ratios

With Examples Showing Use of Tables



This book contains about 400 pages of tabulated gear ratios and examples—14000 two-gear, and millions of possible four-gear combinations. The tables are presented in both common fractional and decimal forms and are divided into four main sections. These sections are arranged differently to facilitate solving, by simple direct methods, any type of gear ratio problem likely to arise.

SECTION 1—Common Fractional Ratios and Decimal Equivalents.

SECTION 2—Decimal Ratios, Logs and Equivalent Pairs of Gears.

SECTION 3—Total Number of Teeth with Equivalent Gear Pairs and Ratios.

SECTION 4—Numbers and Equivalent Gear Factors.

Book is 8-1/2 x 11 Inches. Price, $5 copy

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Gear Design Simplified

Size 8-1/2 x 11 Inches

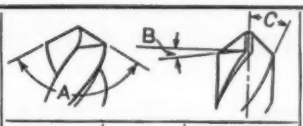
This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price $3 copy.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

MACHINERY'S DATA SHEETS 581 and 582

RECOMMENDATIONS FOR DRILLING VARIOUS MATERIALS—1

Material	Cutting Speed, Feet per Minute	Feed Rate, Inches per Minute	 Point Angle A, Degrees	Lip Relief Angle B, Degrees	Helix Angle C, Degrees	Coolant	Thin Web at Chisel Edge Only	Special Features of Drill
Cast Iron, Soft (150 Brinell)	100–150	4–6	100	12	Std. 20–25	Dry or air jet	V	
Cast Iron, Medium Hard (175 Brinell)	80–90	3–4	100	12	Std. 20–25	Dry or air jet	V	
Cast Iron, Hard (250 Brinell)	70–80	2 1/2–3 1/2	118	12	Std. 20–25	Dry, air jet, or light mineral oil (5 per cent oleic acid)		
Steel, Mild*	60–90	2–2 1/2	118	7–9	Std. 20–25	Soluble oil mixture		
Steel, Alloy†	50–60	1 1/2–2	134–145	7–9	Std. 20–25	Sulphurized oil	V	
Steel, Alloy, Medium Hard (300 Brinell)	40–50	1 1/2–2	145	7	Std. 20–25	Sulphurized oil, 3 to 1 carbon tetrachloride mixture	V	Heavier than standard web
Armor Plate, Medium Hard	35–45	1 1/4–1 3/4	145	7	Std. 20–25	Soluble oil, rich mixture		Heavier than standard web. Short stubby drill
Armor Plate, Laminar Type	20–35	3/4–1	145	7	Std. 20–25	Soluble oil, rich mixture	V	Heavier than standard web. Short stubby drill
Manganese Steel (7–13 Per Cent)	15–20	1/2–1	145	7	25	Sulphurized oil	V	Heavier than standard web
Stainless Steel	30–40	1–1 1/2	125	12	25	Light mineral oil		

*Such as S A E 1112, 1020, 3120. †Such as S A E 1045, 3140, 4140.

MACHINERY'S Data Sheet No. 581, March, 1947 **Compiled by National Automatic Tool Co., Inc.**

RECOMMENDATIONS FOR DRILLING VARIOUS MATERIALS—2

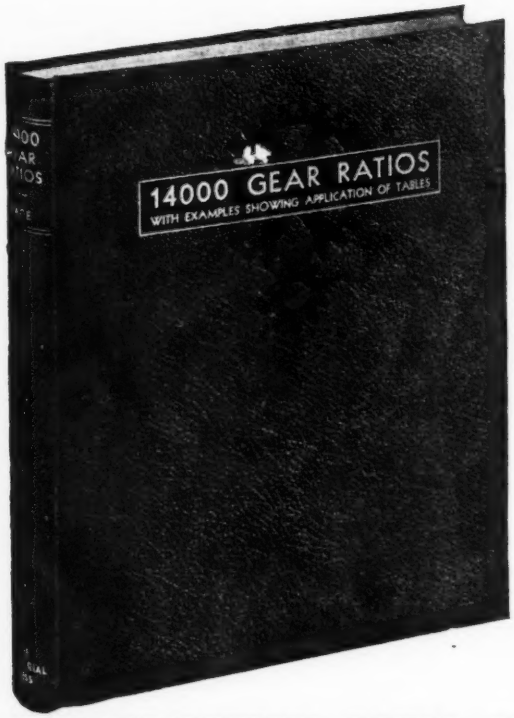
Material	Cutting Speed, Feet per Minute	Feed Rate, Inches per Minute	Point Angle A, Degrees	Lip Relief Angle B, Degrees	Helix Angle C, Degrees	Coolant	Thin Web at Chisel Edge Only	Special Features of Drill
Aluminum (Not alloyed)	200–300	3–4	118	18	25	Soluble oil or equal parts of lard oil and kerosene		Extra wide polished flutes
Magnesium Alloys	200–300	3–4	118	18	*	Dry or mineral seal oil with a high flash point		Extra wide polished flutes; special step-point grind for holes over 1 inch diameter
Zinc Die-Castings	300–400	3–4	118	18	10	Dry		Extra wide polished flutes
Monel Metal	30–50	1/2–3/4	135–145	7–9		Sulphurized oil	V	
Bronze, Soft	200–250	2–2 1/2	118	12		Dry or soluble oil and water		
Copper and Brass (Soft and Medium Hard)	200–300	2 1/2–3	118	15	25	Dry or mineral seal oil		Extra wide polished flutes; cutting edge ground in a plane with the center line or axis
Wood	300–400	4–6	60	20	25	Dry with air vacuum		Extra wide polished flutes
Plastics, Hot-Set; Rubber, Hard; and Fiber	100–300	1–6	60	12	10	Dry with air jet where advisable		Extra wide polished flutes; cutting edge corner rounded to a radius equal to one-quarter of the drill diameter
Plastics, Cold-Set	100–300	1–6	118–135	15–20	25	Soapy water, or mixture of kerosene and 3 to 1 carbon tetrachloride		Extra wide polished flutes; land clearance twice standard; margin clearance one-half standard

*25 degrees for vertical drilling; 10 degrees for horizontal drilling.

MACHINERY'S Data Sheet No. 582, March, 1947 **Compiled by National Automatic Tool Co., Inc.**

14000 Gear Ratios

With Examples Showing Use of Tables



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THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

CHECKING INTERNAL GEAR SIZES BY MEASUREMENT BETWEEN WIRES—1

Even Numbers of Teeth

The dimensions given in this table are for 1 diametral pitch gears and wires of 1.68-inch diameter. For checking gears of any other pitch, divide the dimensions given by the diametral pitch and use wires having a diameter equal to $\frac{1.68}{\text{diametral pitch}}$

No. of Teeth	Pressure Angle				
	14½ deg.	17½ deg.	20 deg.	25 deg.	30 deg.
6	1.68" WIRES TOO LARGE				5.5304
8					7.5850
10				7.5173	9.6083
12				9.5899	11.6225
14				11.6200	13.6320
16			13.5459	13.6377	15.6387
18			15.5901	15.6496	17.6438
20			17.6147	17.6581	19.6478
22		19.5486	19.6311	19.6646	21.6510
24		21.5786	21.6429	21.6697	23.6537
26		23.5983	23.6520	23.6739	25.6559
28		25.6126	25.6591	25.6773	27.6577
30		27.6235	27.6649	27.6801	29.6593
32	29.4774	29.6322	29.6699	29.6826	31.6607
34	31.5095	31.6394	31.6739	31.6847	33.6619
36	33.5314	33.6453	33.6773	33.6866	35.6630
38	35.5472	35.6504	35.6804	35.6882	37.6640
40	37.5599	37.6548	37.6831	37.6895	39.6648
42	39.5702	39.6586	39.6855	39.6907	41.6656
44	41.5788	41.6619	41.6875	41.6918	43.6663
46	43.5861	43.6648	43.6893	43.6929	45.6669
48	45.5924	45.6675	45.6910	45.6939	47.6676
50	47.5979	47.6699	47.6926	47.6948	49.6681
52	49.6027	49.6721	49.6940	49.6956	51.6686
54	51.6070	51.6741	51.6953	51.6963	53.6691
56	53.6109	53.6759	53.6965	53.6970	55.6695
58	55.6144	55.6775	55.6975	55.6976	57.6699
60	57.6175	57.6789	57.6985	57.6981	59.6703
62	59.6204	59.6802	59.6994	59.6987	61.6706
64	61.6230	61.6815	61.7003	61.6992	63.6709
66	63.6254	63.6827	63.7011	63.6996	65.6712
68	65.6277	65.6838	65.7018	65.7001	67.6715
70	67.6297	67.6849	67.7025	67.7005	69.6718
72	69.6316	69.6859	69.7032	69.7008	71.6720
74	71.6334	71.6868	71.7038	71.7012	73.6723
76	73.6351	73.6876	73.7044	73.7015	75.6725
78	75.6366	75.6884	75.7049	75.7019	77.6727
80	77.6381	77.6891	77.7054	77.7022	79.6729
82	79.6395	79.6898	79.7059	79.7025	81.6731
84	81.6408	81.6905	81.7064	81.7027	83.6733
86	83.6420	83.6912	83.7068	83.7030	85.6734
88	85.6431	85.6918	85.7072	85.7032	87.6736
90	87.6442	87.6924	87.7076	87.7035	89.6738
92	89.6452	89.6929	89.7080	89.7037	89.6739
94	91.6462	91.6934	91.7084	91.7039	91.6739

MACHINERY'S Data Sheet No. 583, April, 1947 Compiled by The Van Keuren Co. Boston, Mass.

CHECKING INTERNAL GEAR SIZES BY MEASUREMENT BETWEEN WIRES—2

Even Numbers of Teeth

No. of Teeth	Pressure Angle				
	14½ deg.	17½ deg.	20 deg.	25 deg.	30 deg.
96	93.6472	93.6939	93.7087	93.7041	93.6741
98	95.6481	95.6944	95.7090	95.7043	95.6742
100	97.6489	97.6949	97.7093	97.7045	97.6744
102	99.6497	99.6953	99.7096	99.7047	99.6745
104	101.6505	101.6957	101.7099	101.7049	101.6746
106	103.6512	103.6961	103.7102	103.7050	103.6747
108	105.6519	105.6965	105.7105	105.7052	105.6748
110	107.6526	107.6969	107.7107	107.7053	107.6750
112	109.6532	109.6973	109.7110	109.7055	109.6751
114	111.6538	111.6976	111.7112	111.7056	111.6752
116	113.6544	113.6979	113.7114	113.7058	113.6753
118	115.6550	115.6982	115.7117	115.7059	115.6754
120	117.6556	117.6985	117.7119	117.7060	117.6755
122	119.6561	119.6988	119.7121	119.7062	119.6756
124	121.6566	121.6991	121.7123	121.7063	121.6756
126	123.6571	123.6994	123.7125	123.7064	123.6757
128	125.6575	125.6996	125.7127	125.7065	125.6758
130	127.6579	127.6999	127.7129	127.7066	127.6759
132	129.6583	129.7001	129.7130	129.7067	129.6759
134	131.6588	131.7004	131.7132	131.7068	131.6760
136	133.6592	133.7006	133.7134	133.7069	133.6761
138	135.6596	135.7008	135.7135	135.7070	135.6761
140	137.6600	137.7010	137.7137	137.7071	137.6762
142	139.6604	139.7012	139.7139	139.7021	139.6763
144	141.6608	141.7014	141.7140	141.7073	141.6763
146	143.6612	143.7016	143.7141	143.7074	143.6764
148	145.6615	145.7018	145.7143	145.7075	145.6765
150	147.6618	147.7020	147.7144	147.7076	147.6765
152	149.6621	149.7022	149.7145	149.7077	149.6766
154	151.6624	151.7024	151.7146	151.7077	151.6766
156	153.6627	153.7026	153.7148	153.7078	153.6767
158	155.6630	155.7027	155.7149	155.7079	155.6768
160	157.6633	157.7029	157.7150	157.7079	157.6768
162	159.6636	159.7031	159.7151	159.7080	159.6768
164	161.6639	161.7033	161.7152	161.7080	161.6769
166	163.6642	163.7034	163.7153	163.7081	163.6769
168	165.6645	165.7035	165.7154	165.7082	165.6770
170	167.6647	167.7036	167.7156	167.7082	167.6770
180	177.6658	177.7044	177.7160	177.7085	177.6772
190	187.6668	187.7049	187.7164	187.7088	187.6774
200	197.6678	197.7054	197.7168	197.7090	197.6776
300	297.6735	297.7088	297.7192	297.7105	297.6786
400	397.6762	397.7104	397.7203	397.7112	397.6791
500	497.6778	497.7113	497.7210	497.7117	497.6795
∞	(N—3).6841	(N—3).7151	(N—3).7238	(N—3).7134	(N—3).6808

These data for 1 diametral pitch gears and 1.68-inch diameter wires are based on the Buckingham formulas for measurement of internal spur gears between wires.

MACHINERY'S Data Sheet No. 584, April, 1947 Compiled by The Van Keuren Co. Boston, Mass.

CHECKING INTERNAL GEAR SIZES BY MEASUREMENT BETWEEN WIRES—3

Odd Numbers of Teeth

The dimensions given in this table are for 1 diametral pitch gears and wires of 1.68-inch diameter. For checking gears of any other pitch, divide the dimensions given by the diametral pitch and use wires having a diameter equal to $\frac{1.68}{\text{diametral pitch}}$

No. of Teeth	Pressure Angle, Degrees				
	14½	17½	20	25	30
5	1.68" WIRES TOO LARGE				4.2928
7					6.4387
9				8.4598	8.4934
11				10.5177	10.5266
13			12.4222	12.5514	12.5493
15			14.5026	14.5745	14.5660
17			16.5414	16.5915	16.5789
19		18.4691	18.5668	18.6047	18.5891
21		20.5136	20.5854	20.6152	20.5975
23		22.5414	22.5997	22.6238	22.6044
25		24.5615	24.6112	24.6311	24.6103
27		26.5769	26.6206	26.6372	26.6153
29		28.5892	28.6285	28.6424	28.6196
31	30.4589	30.5994	30.6353	30.6470	30.6234
33	32.4867	32.6079	32.6411	32.6510	32.6268
35	34.5071	34.6153	34.6462	34.6546	34.6298
37	36.5229	36.6216	36.6507	36.6577	36.6325
39	38.5357	38.6271	38.6547	38.6606	38.6348
41	40.5463	40.6320	40.6582	40.6631	40.6370
43	42.5556	42.6364	42.6614	42.6655	42.6390
45	44.5635	44.6403	44.6644	44.6676	44.6408
47	46.5704	46.6439	46.6670	46.6695	46.6425
49	48.5765	48.6471	48.6694	48.6713	48.6440
51	50.5820	50.6500	50.6716	50.6729	50.6454
53	52.5869	52.6527	52.6737	52.6744	52.6467
55	54.5913	54.6552	54.6756	54.6758	54.6479
57	56.5953	56.6575	56.6774	56.6771	56.6490
59	58.5990	58.6596	58.6789	58.6784	58.6501
61	60.6024	60.6615	60.6805	60.6796	60.6511
63	62.6055	62.6633	62.6819	62.6806	62.6520
65	64.6083	64.6651	64.6832	64.6816	64.6529
67	66.6110	66.6666	66.6844	66.6825	66.6537
69	68.6135	68.6681	68.6856	68.6834	68.6544
71	70.6158	70.6695	70.6867	70.6843	70.6552
73	72.6179	72.6708	72.6878	72.6851	72.6558
75	74.6199	74.6721	74.6888	74.6858	74.6565
77	76.6218	76.6733	76.6897	76.6865	76.6571
79	78.6236	78.6744	78.6905	78.6872	78.6577
81	80.6253	80.6754	80.6914	80.6878	80.6583
83	82.6270	82.6764	82.6922	82.6884	82.6588
85	84.6285	84.6774	84.6929	84.6890	84.6593
87	86.6299	86.6783	86.6936	86.6896	86.6597
89	88.6313	88.6792	88.6943	88.6901	88.6602
91	90.6326	90.6800	90.6950	90.6907	90.6607
93					

MACHINERY'S Data Sheet No. 585, May, 1947
Compiled by The Van Keuren Co.
Boston, Mass.

CHECKING INTERNAL GEAR SIZES BY MEASUREMENT BETWEEN WIRES—4

Odd Numbers of Teeth

No. of Teeth	Pressure Angle, Degrees				
	14½	17½	20	25	30
95	92.6338	92.6808	92.6956	92.6911	92.6611
97	94.6350	94.6816	94.6962	94.6916	94.6615
99	96.6361	96.6823	96.6968	96.6921	96.6619
101	98.6372	98.6829	98.6974	98.6925	98.6623
103	100.6382	100.6836	100.6979	100.6929	100.6627
105	102.6392	102.6842	102.6984	102.6933	102.6630
107	104.6401	104.6848	104.6989	104.6937	104.6633
109	106.6410	106.6854	106.6994	106.6940	106.6637
111	108.6419	108.6860	108.6998	108.6944	108.6640
113	110.6427	110.6866	110.7002	110.6947	110.6643
115	112.6434	112.6871	112.7006	112.6951	112.6645
117	114.6442	114.6876	114.7010	114.6954	114.6648
119	116.6450	116.6881	116.7014	116.6957	116.6651
121	118.6457	118.6885	118.7018	118.6960	118.6654
123	120.6464	120.6890	120.7022	120.6963	120.6656
125	122.6470	122.6894	122.7026	122.6966	122.6659
127	124.6477	124.6898	124.7029	124.6968	124.6661
129	126.6483	126.6902	126.7032	126.6971	126.6663
131	128.6489	128.6906	128.7036	128.6973	128.6665
133	130.6495	130.6910	130.7039	130.6976	130.6667
135	132.6500	132.6914	132.7042	132.6978	132.6669
137	134.6505	134.6918	134.7045	134.6980	134.6672
139	136.6510	136.6921	136.7047	136.6982	136.6674
141	138.6515	138.6924	138.7050	138.6985	138.6675
143	140.6520	140.6928	140.7053	140.6987	140.6677
145	142.6525	142.6931	142.7055	142.6989	142.6679
147	144.6530	144.6934	144.7058	144.6991	144.6681
149	146.6534	146.6937	146.7061	146.6993	146.6683
151	148.6538	148.6940	148.7063	148.6995	148.6684
153	150.6543	150.6943	150.7065	150.6996	150.6686
155	152.6547	152.6946	152.7068	152.6998	152.6687
157	154.6551	154.6948	154.7070	154.6999	154.6689
159	156.6555	156.6951	156.7072	156.7001	156.6691
161	158.6559	158.6953	158.7074	158.7003	158.6692
163	160.6563	160.6956	160.7076	160.7005	160.6693
165	162.6567	162.6958	162.7078	162.7006	162.6695
167	164.6570	164.6961	164.7080	164.7008	164.6696
169	166.6573	166.6963	166.7082	166.7010	166.6697
171	168.6576	168.6965	168.7084	168.7011	168.6699
181	178.6592	178.6976	178.7092	178.7018	178.6705
191	188.6605	188.6985	188.7100	188.7024	188.6710
201	198.6618	198.6994	198.7107	198.7029	198.6715
301	298.6694	298.7047	298.7151	298.7064	298.6745
401	398.6731	398.7073	398.7172	398.7082	398.6760
501	498.6753	498.7089	498.7185	498.7092	498.6770
∞	(N—3).6841	(N—3).7151	(N—3).7238	(N—3).7134	(N—3).6808

These data for 1 diametral pitch gears and 1.68-inch diameter wires are based on the Buckingham formulas for measurement of internal spur gears between wires.

MACHINERY'S Data Sheet No. 586, May, 1947
Compiled by The Van Keuren Co.
Boston, Mass.

MACHINERY'S DATA SHEETS 587 and 588

THRUST, IN POUNDS, REQUIRED FOR DRILLING—1

Drill Size	Feed, in Inches per Revolution									
	0.001	0.005	0.010	0.015	0.020	0.001	0.005	0.010	0.015	0.020
	Cast Iron					Machine Steel				
1/16	20	74	128	177	223	42	128	207	274	335
3/32	27	98	170	235	296	55	170	275	364	445
1/8	33	120	208	288	362	68	207	336	445	544
3/16	44	159	276	382	481	90	275	446	591	723
1/4	54	194	338	467	588	110	337	546	723	884
5/16	63	227	395	546	688	128	394	638	846	1035
3/8	71	258	449	621	781	146	447	725	961	1175
7/16	79	287	500	692	871	163	498	807	1070	1310
1/2	87	315	549	759	956	179	547	886	1175	1435
9/16	95	342	596	825	1040	194	594	962	1275	1560
5/8	102	369	642	888	1115	209	640	1035	1375	1680
11/16	109	394	686	949	1195	223	684	1105	1470	1795
3/4	116	419	729	1010	1270	237	727	1175	1560	1905
13/16	122	443	771	1065	1340	251	768	1245	1650	2015
7/8	129	467	812	1125	1415	264	809	1310	1740	2125
15/16	135	490	852	1180	1485	277	849	1375	1825	2230
1	141	512	892	1235	1550	290	889	1440	1910	2330
1 1/8	154	556	968	1340	1685	315	965	1565	2075	2535
1 1/4	165	599	1040	1440	1815	339	1040	1685	2230	2725
1 3/8	178	640	1115	1540	1940	362	1110	1800	2385	2915
1 1/2	188	680	1185	1640	2060	385	1180	1910	2535	3100
1 5/8	199	720	1255	1730	2180	407	1250	2020	2680	3275
1 3/4	209	758	1320	1825	2295	429	1315	2130	2825	3450
1 7/8	220	795	1385	1915	2410	450	1380	2235	2965	3620
2	230	832	1450	2005	2520	471	1445	2340	3100	3790
2 1/4	249	904	1575	2175	2740	511	1570	2540	3370	4115
2 1/2	268	973	1695	2340	2950	551	1690	2735	3625	4430
2 3/4	287	1040	1810	2505	3150	589	1805	2925	3875	4735
3	305	1105	1925	2660	3350	626	1915	3105	4120	5030
3 1/2	340	1230	2145	2965	3730	697	2135	3460	4590	5605

MACHINERY'S Data Sheet No. 587, June, 1947

Compiled by Canedy-Otto Mfg. Co.
Chicago Heights, Ill.

THRUST, IN POUNDS, REQUIRED FOR DRILLING—2

Drill Size	Feed, in Inches per Revolution									
	0.001	0.005	0.010	0.015	0.020	0.001	0.005	0.010	0.015	0.020
	Cast Steel					0.70 Per Cent Carbon Steel				
1/16	29	96	161	219	271	50	146	233	306	371
3/32	38	127	214	291	360	66	195	310	406	492
1/8	47	156	262	356	440	81	238	379	497	602
3/16	62	207	348	472	585	108	316	503	660	800
1/4	76	253	425	578	715	132	387	615	807	978
5/16	88	296	497	675	836	154	452	719	943	1145
3/8	101	336	565	767	950	175	513	817	1070	1300
7/16	112	374	629	855	1060	195	572	910	1195	1445
1/2	123	411	691	938	1160	214	628	999	1310	1590
9/16	134	446	750	1020	1260	232	682	1085	1425	1725
5/8	144	480	808	1095	1360	250	734	1170	1530	1860
11/16	154	514	864	1170	1450	267	785	1250	1640	1985
3/4	163	546	918	1245	1545	284	834	1325	1740	2110
13/16	173	577	971	1320	1630	300	882	1405	1840	2230
7/8	182	608	1020	1390	1720	316	929	1475	1940	2350
15/16	191	668	1075	1455	1805	332	975	1550	2035	2470
1	200	698	1125	1525	1890	347	1020	1620	2130	2580
1 1/8	217	725	1220	1655	2050	377	1110	1760	2310	2805
1 1/4	233	780	1310	1780	2205	406	1190	1895	2490	3020
1 3/8	250	834	1400	1905	2360	434	1175	2030	2660	3225
1 1/2	265	887	1490	2025	2510	461	1355	2155	2830	3430
1 5/8	280	938	1575	2140	2650	487	1435	2280	2990	3625
1 3/4	295	988	1660	2255	2795	513	1510	2400	3150	3820

MACHINERY'S Data Sheet No. 588, June, 1947

Compiled by Canedy-Otto Mfg. Co.
Chicago Heights, Ill.

AREAS AND WEIGHTS OF MAGNESIUM-ALLOY RODS AND BARS

Round Bars			Square Bars			Hexagonal Bars		
Diameter, Inches	Area, Square Inches	Weight, Pounds per Foot	Width, Inches	Area, Square Inches	Weight, Pounds per Foot	Width Across Flats, Inches	Area, Square Inches	Weight, Pounds per Foot
1/8	0.012	0.009	1/8	0.016	0.012	1/4	0.054	0.041
3/16	0.028	0.022	3/16	0.035	0.027	5/16	0.084	0.064
1/4	0.049	0.038	1/4	0.063	0.048	3/8	0.122	0.094
5/16	0.077	0.059	5/16	0.098	0.075	7/16	0.166	0.127
3/8	0.110	0.084	3/8	0.141	0.108	1/2	0.216	0.166
7/16	0.150	0.115	7/16	0.191	0.147	9/16	0.274	0.210
1/2	0.196	0.151	1/2	0.250	0.192	5/8	0.338	0.259
9/16	0.248	0.190	9/16	0.316	0.243	11/16	0.409	0.314
5/8	0.307	0.236	5/8	0.391	0.300	3/4	0.487	0.374
11/16	0.371	0.285	11/16	0.473	0.363	13/16	0.571	0.438
3/4	0.442	0.339	3/4	0.563	0.432	7/8	0.663	0.509
13/16	0.518	0.398	13/16	0.660	0.507	15/16	0.761	0.584
7/8	0.601	0.462	7/8	0.766	0.588	1	0.865	0.665
15/16	0.690	0.530	15/16	0.879	0.675	1 1/16	0.977	0.750
1	0.785	0.603	1	1.00	0.768	1 1/8	1.09	0.837
1 1/16	0.887	0.681	1 1/16	1.13	0.868	1 3/16	1.22	0.937
1 1/8	0.994	0.763	1 1/8	1.27	0.975	1 1/4	1.35	1.04
1 3/16	1.11	0.852	1 3/16	1.41	1.08	1 5/16	1.49	1.14
1 1/4	1.23	0.945	1 1/4	1.56	1.20	1 3/8	1.64	1.26
1 5/16	1.35	1.04	1 5/16	1.72	1.32	1 7/16	1.79	1.37
1 3/8	1.48	1.14	1 3/8	1.89	1.45	1 1/2	1.95	1.50
1 7/16	1.62	1.24	1 7/16	2.07	1.59	1 9/16	2.11	1.62
1 1/2	1.77	1.36	1 1/2	2.25	1.73	1 5/8	2.28	1.75
1 9/16	1.92	1.47	1 9/16	2.44	1.87	1 11/16	2.46	1.89
1 5/8	2.07	1.59	1 5/8	2.64	2.03	1 3/4	2.65	2.03
1 11/16	2.24	1.72	1 11/16	2.85	2.19	1 13/16	2.84	2.18
1 3/4	2.40	1.84	1 3/4	3.06	2.38	1 7/8	3.04	2.33
1 13/16	2.58	1.98	1 13/16	3.29	2.53	1 15/16	3.25	2.50
1 7/8	2.76	2.12	1 7/8	3.52	2.70	2	3.46	2.66
1 15/16	2.95	2.26	1 15/16	3.75	2.88	2 1/8	3.91	3.00
2	3.14	2.41	2	4.00	3.07	2 1/4	4.38	3.36
2 1/8	3.55	2.73	2 1/8	4.52	3.47	2 3/8	4.88	3.75
2 1/4	3.98	3.06	2 1/4	5.06	3.89	2 1/2	5.41	4.15
2 3/8	4.43	3.40	2 3/8	5.64	4.33	2 5/8	5.96	4.58
2 1/2	4.91	3.77	2 1/2	6.25	4.80	2 3/4	6.54	5.02
2 5/8	5.41	4.15	2 5/8	6.89	5.29	2 7/8	7.14	5.48
2 3/4	5.94	4.56	2 3/4	7.56	5.81	3	7.79	5.98
2 7/8	6.48	4.98	2 7/8	8.25	6.34	3 1/4	9.14	7.02
3	7.07	5.43	3	9.00	6.91	3 1/2	10.6	8.14
3 1/8	7.67	5.89	3 1/8	9.77	7.50	3 3/4	12.2	9.35
3 1/4	8.29	6.37	3 1/4	10.6	8.14	4	13.8	10.6
3 3/8	8.95	6.87	3 3/8	11.4	8.75	4 1/2	17.5	13.4
3 1/2	9.62	7.39	3 1/2	12.2	9.37	5	21.6	16.6
3 5/8	10.3	7.91	3 5/8	13.1	10.1	5 1/2	26.2	20.1
3 3/4	11.0	8.45	3 3/4	14.0	10.8	6	31.1	23.9
4	12.6	9.68	4	16.0	12.3	6 1/2	36.6	28.1

NOTE: Weights in table are for Dowmetal M (S.A.E. No. 522). For weights of Dowmetal Fs-1 (S.A.E. No. 52), multiply weights shown by 1.005; for Dowmetal J-1 (S.A.E. No. 520) and Dowmetal O-1, multiply by 1.022; for pure magnesium, multiply by 0.989.

MACHINERY'S Data Sheet No. 590, July, 1947

Compiled by the Dow Chemical Co.

WEIGHTS OF ALUMINUM SHEETS, RODS, AND BARS

Sheets					Rods and Bars		
American Wire or Brown & Sharpe Gage No.	Thickness, Inch	SAE Alloys Nos. 26 and 27	SAE Alloy No. 28	Commercially Pure (99 to 99.4 Per Cent)	Diameter or Size, Inches	Round	Hexagon*
		Pounds per Square Foot				Pounds per Foot†	
0000	0.4600	6.680	6.410	6.490	1/8	0.015	.....
000	0.4096	5.950	5.710	5.780	5/32	0.023	.....
00	0.3648	5.290	5.090	5.140	3/16	0.034	0.037
0	0.3249	4.720	4.530	4.580	7/32	0.046	0.051
1	0.2893	4.200	4.030	4.080	1/4	0.060	0.066
2	0.2576	3.738	3.591	3.632	9/32	0.076	.....
3	0.2294	3.329	3.198	3.234	5/16	0.093	0.103
4	0.2043	2.964	2.848	2.880	11/32	0.113	0.125
5	0.1819	2.640	2.536	2.565	3/8	0.135	0.149
6	0.1620	2.351	2.258	2.284	7/16	0.184	0.203
7	0.1443	2.094	2.012	2.034	1/2	0.240	0.264
8	0.1285	1.865	1.792	1.812	9/16	0.304	0.335
9	0.1144	1.660	1.595	1.613	5/8	0.375	0.414
10	0.1019	1.479	1.420	1.437	11/16	0.454	0.501
11	0.0907	1.316	1.264	1.279	3/4	0.540	0.595
12	0.0808	1.172	1.126	1.139	13/16	0.633	0.700
13	0.0720	1.045	1.004	1.015	7/8	0.735	0.811
14	0.0641	0.930	0.894	0.904	15/16	0.844	0.930
15	0.0571	0.829	0.796	0.805	1	0.961	1.06
16	0.0508	0.737	0.708	0.716	1 1/16	1.08	1.20
17	0.0453	0.657	0.631	0.639	1 1/8	1.22	1.34
18	0.0403	0.585	0.562	0.568	1 3/16	1.35	1.49
19	0.0359	0.5210	0.5010	0.5060	1 1/4	1.50	1.65
20	0.0320	0.4640	0.4460	0.4510	1 5/16	1.66	1.82
21	0.0285	0.4140	0.3970	0.4020	1 3/8	1.81	2.00
22	0.0253	0.3671	0.3527	0.3567	1 7/16	1.99	2.18
23	0.0226	0.3280	0.3150	0.3186	1 1/2	2.16	2.38
24	0.0201	0.2917	0.2802	0.2834	1 9/16	2.34	2.58
25	0.0179	0.2597	0.2495	0.2524	1 5/8	2.54	2.80
26	0.0159	0.2307	0.2216	0.2242	1 11/16	2.74	.....
27	0.0142	0.2060	0.1980	0.2002	1 3/4	2.98	3.25
28	0.0126	0.1828	0.1756	0.1776	1 13/16	3.15	.....
29	0.0113	0.1640	0.1575	0.1593	1 7/8	3.37	3.73
30	0.0100	0.1451	0.1394	0.1410	1 15/16	3.60	.....
31	0.0089	0.1296	0.1245	0.1259	2	3.84	4.23
32	0.0080	0.1154	0.1108	0.1121	2 1/16	4.09	.....
33	0.0071	0.1027	0.0987	0.0998	2 1/8	4.34	.....
34	0.0063	0.0914	0.0878	0.0888	2 3/16	4.59	.....
35	0.0056	0.0814	0.0782	0.0791	2 1/4	4.86	.....
36	0.0050	0.0726	0.0697	0.0705	2 3/8	5.41	.....
37	0.0045	0.0646	0.0620	0.0627	2 1/2	6.00	.....
38	0.0040	0.0576	0.0553	0.0560	2 5/8	6.62	.....
39	0.0035	0.0512	0.0492	0.0498	2 3/4	7.26	.....
40	0.0031	0.0456	0.0438	0.0443	2 7/8	7.94	.....
					3	8.64	.....

*Size of hexagon equals distance across flats

†Based upon weight of 0.1018 pound per cubic inch for aluminum-alloy screw machine stock

MACHINERY'S Data Sheet No. 589, July, 1947

WEIGHTS OF MAGNESIUM ALLOY SHEETS AND PLATES*—1

Thickness, Inch	American or B. & S. Gage No.	Weight, Pounds per Square Foot	Standard Widths, Inches	Standard Lengths, Inches: 60	72	96	120	144
				Weights in Pounds				
0.016	26	0.147	24	1.47	1.76	....	....	....
0.018	25	0.166	24	1.66	1.99	....	....	....
0.020	24	0.184	24	1.84	2.21	2.94	....	....
			30	2.30	2.76	....	....	....
0.023	23	0.212	24	2.12	2.54	3.39	....	....
			30	2.65	3.18	....	....	....
0.025	22	0.230	24	2.3	2.76	3.68	....	....
			30	2.87	3.45	....	....	....
0.028	21	0.258	24	2.58	3.10	4.13	....	....
			30	3.22	3.87	....	....	....
0.032	20	0.295	24	2.95	3.54	4.72	5.9	....
			30	3.69	4.42	5.90	7.38	....
			36	4.42	5.31	7.08	....	....
0.036	19	0.332	24	3.32	3.98	5.31	6.64	....
			30	4.15	4.98	6.64	8.30	....
			36	4.98	5.98	7.97	....	....
0.040	18	0.369	24	3.69	4.43	5.90	7.38	....
			30	4.61	5.53	7.38	9.22	....
			36	5.53	6.64	8.85	11.1	....
0.045	17	0.415	24	4.15	4.98	6.64	8.30	....
			30	5.19	6.22	8.30	10.4	....
			36	6.22	7.47	9.96	12.5	....
0.051	16	0.470	24	4.70	5.64	7.52	9.40	11.3
			30	5.87	7.05	9.40	11.7	14.1
			36	7.05	8.46	11.3	14.1	16.9
			42	8.22	9.87	13.2	16.4	19.7
0.057	15	0.525	24	5.25	6.30	8.4	10.5	12.6
			30	6.57	7.88	10.5	13.1	15.8
			36	7.88	9.45	12.6	15.8	18.9
			42	9.19	10.1	14.7	18.4	22.1
0.064	14	0.590	24	5.9	7.07	9.45	11.8	14.2
			30	7.38	8.85	11.8	14.7	17.7
			36	8.85	10.6	14.2	17.7	21.2
			42	10.3	12.4	16.5	20.6	24.8
0.072	13	0.662	24	6.54	7.85	10.5	13.1	15.7
			30	8.17	9.80	13.1	16.3	19.6
			36	9.80	11.8	15.7	19.6	23.5
			42	11.4	13.7	18.3	22.9	27.4
0.081	12	0.746	24	7.46	8.96	11.9	14.9	17.9
			30	9.34	11.2	14.9	18.6	22.4
			36	11.2	13.4	17.9	22.4	26.8
			42	13.0	15.7	20.9	26.1	31.3
			48	14.9	17.9	23.9	29.8	35.8
0.091	11	0.838	24	8.38	10.1	13.4	16.8	20.1
			30	10.5	12.6	16.8	20.9	25.1
			36	12.6	15.1	20.1	25.1	30.2
			42	14.7	17.6	23.5	29.3	35.2
			48	16.8	20.1	26.8	33.5	40.2
0.102	10	0.940	24	9.4	11.3	15.0	18.8	22.6
			30	11.7	14.1	18.8	23.5	28.2
			36	14.1	16.9	22.6	28.2	33.8
			42	16.4	19.7	26.3	32.9	39.4
			48	18.8	22.6	30.0	37.6	45.1

*Sheet is defined as rolled metal up to 0.250 inch thick. Material 0.250 inch thick and over is designated as plate. See also note at end of Data Sheet No. 592.

MACHINERY'S Data Sheet No. 591, August, 1947 Compiled by the Dow Chemical Co.

WEIGHTS OF MAGNESIUM ALLOY SHEETS AND PLATES—2

Thickness, Inch	American or B. & S. Gage No.	Weight, Pounds per Square Foot	Standard Widths, Inches	Standard Lengths, Inches: 60	72	96	120	144
				Weights in Pounds				
0.114	9	1.05	24	10.5	12.6	16.8	21.0	25.2
			30	13.1	15.7	21.0	26.2	31.5
			36	15.7	18.9	25.2	31.5	37.8
			42	18.4	22.1	29.4	36.7	44.1
			48	21.0	25.2	33.6	42.0	50.4
0.128	8	1.18	24	11.8	14.2	18.9	23.6	28.3
			30	14.7	17.7	23.6	29.4	35.4
			36	17.7	21.2	28.3	35.4	42.5
			42	20.6	24.8	33.0	41.3	49.5
			48	23.6	28.3	37.8	47.2	56.6
0.156	5/32	1.44	24	14.4	17.3	23.1	28.8	34.6
			30	18.0	21.6	28.8	36.0	43.2
			36	21.6	25.9	34.6	43.2	51.9
			42	25.2	30.2	40.3	50.4	60.5
			48	28.8	34.6	46.1	57.6	69.1
0.188	3/16	1.73	24	17.3	20.8	27.7	34.6	41.5
			30	21.6	25.9	34.6	43.3	51.9
			36	25.9	31.2	41.5	51.9	62.3
			42	30.3	36.4	48.4	60.5	72.6
			48	34.6	41.5	55.4	69.2	82.5
0.219	7/32	2.02	24	20.2	24.2	32.3	40.4	48.5
			30	25.2	30.3	40.4	50.5	60.6
			36	30.3	36.4	48.5	60.6	72.7
			42	35.4	42.4	56.6	70.7	84.9
			48	40.4	48.5	64.7	80.8	....
0.250	1/4	2.30	24	23.0	27.6	36.8	46.0	55.2
			30	28.8	34.5	46.0	57.5	69.0
			36	34.5	41.4	55.2	69.0	82.8
			42	40.3	48.3	54.4	80.5	....
			48	46.0	55.2	73.6	92.0	....
0.313	5/16	2.88	24	28.8	34.6	46.1	57.6	69.1
			30	36.0	43.2	57.6	72.0	86.4
			36	43.2	51.8	69.1	86.4	....
			42	50.4	60.5	80.6	....	....
			48	57.6	69.1	92.2	....	....
0.375	3/8	3.46	24	34.6	41.5	55.4	69.2	83.0
			30	43.3	51.9	69.2	86.5	....
			36	51.9	62.3	83.0	....	....
			42	60.6	72.7	....	....	....
			48	69.2	83.0	....	....	....
0.437	7/16	4.03	24	40.3	48.4	64.5	....	....
			30	50.4	60.5	80.6	....	....
			36	60.5	72.5	....	....	....
			42	70.5	84.6	....	....	....
			48	80.6	....	....	....	....
0.500	1/2	4.61	24	46.1	55.3	73.8	92.2	....
			30	57.6	69.2	92.2	....	....
			36	69.2	83.0	....	....	....
			42	80.7	....	....	....	....
			48	92.2	....	....	....	....

Note: The weights in this table are for Dowmetal M (SAE No. 51). To obtain comparable weights for Dowmetal FS-1 (SAE No. 510), multiply the weights shown by 1.005. For Dowmetal J-1 (SAE No. 511), multiply the weights shown by 1.022.

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